ISSN 0193-6484

Chemistry International

The news magazine of the International Union of Pure and Applied Chemistry (IUPAC)

IUPAC

1994, Vol. 16, No. 1 (January)

Blackwell Scientific Publications

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The news magazine of the International Union of Pure and Applied Chemistry (IUPAC)

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Six issues of *Chemistry International* will be published bimonthly in 1994. The 1994 subscription rate including postage is GBP 58.00 (UK and overseas except North America) or USD 91.00 (US and Canada). The individual subscription rate is GBP 27.50 (UK and overseas except North America) or USD 39.50 (US and Canada). Microfiche subscriptions are available simultaneously with the printed edition, and microfilm at the end of the subscription year. Subscription orders may be placed directly with IUPAC's official publisher, Blackwell Scientific Publications Ltd, PO Box 88, Oxford, UK.

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Front cover: UNIDO, Vienna, Austria..

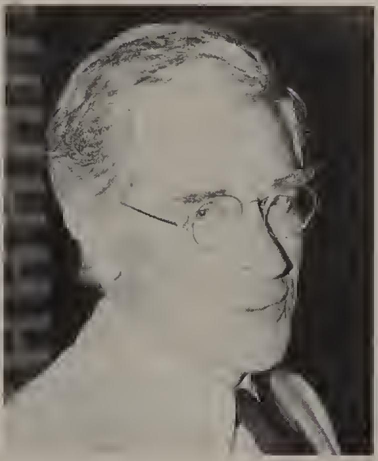
International Union of Pure and Applied Chemistry

New edition of the IUPAC ‘Green Book’

Ian Mills

The Green Book is an invaluable reference book to have on your desk. Not convinced? Then try the quiz below.

Ian Mills is Professor of Chemical Spectroscopy at the University of Reading, UK, and Chairman of the Interdivisional Committee on Nomenclature and Symbols (IDCNS)



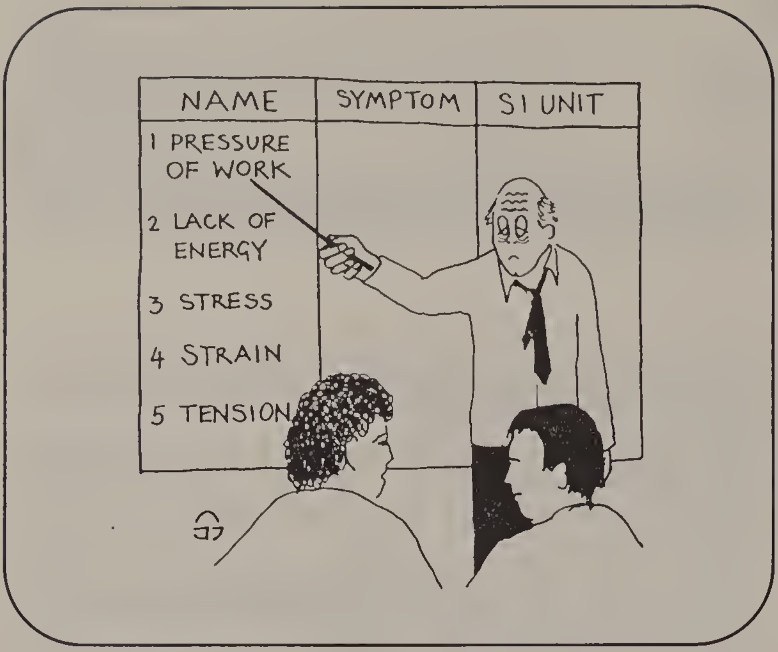
The IUPAC Green Book, *Quantities, Units and Symbols in Physical Chemistry,* is a handbook of advice and assistance on units and symbols for the day-to-day use of practising scientists. The objective of the book is simply to improve the standard of scientific communication by helping us to all speak the same scientific language, to which we can all say ‘amen’. The first edition of the book was published in its present form in 1988[1], and now a second revised and extended edition has just been published.[2] For those familiar with the 1988 edition, the full subject index which has been added to the new edition will prove invaluable; other new additions are sections on quantum chemical calculations, laser physics, and molecular dynamics and molecular beam scattering, and there are also new sections on dimensionless quantities, and a table of abbreviations and acronyms used in chemistry. There are also many small revisions to the previous edition.

After a short introductory chapter (8 pp.) on physical quantities and quantity calculus, and the general rules for symbols for quantities and units, the longest chapter in the book (chapter 2; 56 pp.) consists of lists of symbols and names for quantities in physical chemistry, classified by subject, with a brief defining equation, the appropriate invaluable guide to notation in the many specialized areas of physics and chemistry. Later chapters are concerned with SI and non-SI units (chapter 3; 10 pp.), recommended mathematical symbols (chapter 4; 4 pp.), fundamental constants and particle properties (chapters 5 and 6; 2 and 8 pp.), and the conversion of units from the various non-SI systems in use, such as cgs, esu, emu, gaussian, and atomic units, to the SI (Chapter 7; 18 pp., including an extensive table of non-SI units and conversion factors).

For those who become familiar with it, the Green Book can be an invaluable reference to have on your desk. As one of the authors responsible for preparing this book for publication I might, of course, be thought to be prejudiced! However, for those who remain unconvinced, try the following quiz:

1 What is the symbol for amount of substance (also called chemical amount)?
2 What is the definition of the SI base unit for amount of substance, the mole?
3 What is the affinity of a chemical reaction? How is it defined, and what is its SI unit?
4 What is the affinity of a chemical reaction? How is it defined, and what is its SI unit?
5 Define the extent of reaction ξ (SI unit: mole) for a chemical reaction?
6 What is the SI unit, and the commonly used unit, of molar electric conductivity?
7 What do the acronyms RADAR, REMPI, RHEED, and STEM stand for?
8 Name 12 different quantities for which the symbol μ is commonly used?
9 Define the number-average, mass-average, and *Z*-average molar masses of a polymer.
10 How is the reduced spin–spin coupling constant K_{AB} in NMR spectroscopy related to the more familiar (indirect) spin–spin constant J_{AB}? Why is K_{AB} sometimes a more useful quantity?
11 The magnetic susceptibility of a sample is described as ‘–15 cgs ppm’. Convert this into SI units.
12 Give the present (since 1983) definition of the metre.
13 The integrated absorption intensity of the 1479 cm^{-1} band in the infrared spectrum of benzene is recorded to be 2.34 km mol^{-1}. Convert this (i) into an integrated cross-section in pm^2, and (ii) into an intensity in atm^{-1} cm^{-2} at 20°C.
14 The étendue of an optical instrument is a measure of its throughput, or light gathering power. Define fluence; give its symbol, and SI unit.
15 Define the coulomb integral J_{ij} and the exchange integral K_{ij} between two molecular orbitals ϕ_i and ϕ_j in Hartree-Fock SCF-MO theory.
16 There are two accepted definitions of the electronegativity χ of an atom; give them both. In what units is χ usually recorded?
17 What is the meaning of the units ppb and ppt? Why should they not be used?
18 Give the SI prefixes for 10^{-15}, 10^{-18}, 10^{-21} and 10^{-24}.
19 What is the definition of the year?
20 Will the year 3200 be a leap year?

It would take between 15 and 30 seconds to answer any one of these questions if you had the Green Book in your hand (use the subject index, or the symbol index, to locate the desired page). If you wish to take this quiz more seriously, mark yourself out of 20: 14 or more is clearly first class, 12 or 13 an upper second, 10 or 11 a lower second, and 8 or 9 a third! Then go and buy the Green Book.



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1 Mills I, Cvitaš T, Homann K, Kallay N, Kuchitsu K. *Quantities, Units and Symbols in Physical Chemistry*, 1st edn. Blackwell Scientific Publications, Oxford (1988).
2 Mills I, Cvitaš T, Homann K, Kallay N, Kuchitsu K. *Quantities, Units and Symbols in Physical Chemistry*, 2nd edn. Blackwell Scientific Publications, Oxford (1993).

Quantities, Units and Symbols in Physical Chemistry, *2nd edn, is edited by Ian Mills, Tomislav Cvitaš, Klaus Homann, Nikola Kallay and Kozo Kuchitsu and published by Blackwell Scientific Publications, Oxford, UK, 1993. ix + 176 pp. ISBN 0-632-035838. Price: GBP 14.95/USD 21.00 approx (pbk). Members discount price* GBP 9.00/USD 12.60. It is distributed in North America by CRC Press, Boca Raton, Florida, USA.

Forest dieback and ammonia – a typical Dutch problem

Sjaak Slanina

This is the first of a series of articles on regional environmental problems prepared by members of the IUPAC Commission on Atmospheric Chemistry.

Acid deposition or ozone?

In recent years there has been much debate on whether soil acidification or ozone is the main cause of the widespread forest dieback observed throughout Europe apart from perhaps the Mediterranean countries. It has been widely assumed that one but not both of these factors is primarily responsible. However the geographic distribution and historical development of both soil acidification and ambient ozone concentrations do not correlate with the development of forest dieback in Europe.

The oldest hypothesis states that acid deposition resulting in soil acidification and the liberation of aluminium ions is the prime cause of tree dieback. This is difficult to accept if one regards the distribution of acid deposition over Europe.

Tree dieback was first observed in remote areas of Germany but not in those areas of The Netherlands which are characterized by weakly buffered soils. The latter receive more than three times the amount of acid deposition measured in Southern Germany. In Germany, most sick and dead trees are found at higher altitudes. For the large part, these may be considered as 'background areas' as far as acid deposition is concerned.

The ozone theory is favoured by the fact that ozone concentrations increase with altitude and that high ozone concentrations are observed in the so-called background areas. In The Netherlands, on the other hand, only little tree dieback has been observed in areas exposed to very high ozone concentrations. The ozone concentrations in these regions (in the Northwest of The Netherlands) are comparable to those found in Southwest Germany at altitudes between 1200 and 1400 metres.

Nitrification

The flux of deposited air pollutants through the soil into groundwater is monitored at a number of locations in The Netherlands. At most of these locations little or no ammonium is detected. Large concentrations of nitrate have been found however. Soil acidification has also been observed to an extent that cannot be explained by the deposition of acid or acid forming compounds by dry or wet deposition processes.

The cause of this phenomenon is the conversion of ammonium to nitrate by microorganisms:

$$NH_4^+ + 2O_2 \rightarrow NO_3^- + H_2O + 2H^+$$

So two H^+ ions are produced per ammonium ion. If NH_3 is deposited, the net production is one H^+ ion per NH_3 molecule.

By combining estimates of dry and wet deposition and assuming complete nitrification, an approximate value can be given for the acid deposition in The Netherlands. For each hectare an average value of 5 000 moles per year is obtained (Fig. 1) with ammonium contributing more than 45% of this.

In reality, the situation is even worse for forest ecosystems. The edge of the forest causes additional atmospheric turbulence resulting in reduced atmospheric resistance to dry deposition. The forest edge produces eddies which efficiently transport air pollutants from the atmosphere to the canopy. If we take this process into account, about 7 000 moles per year of acid are deposited on each hectare of Dutch woods. Ammonia is responsible for more than 50% of this.

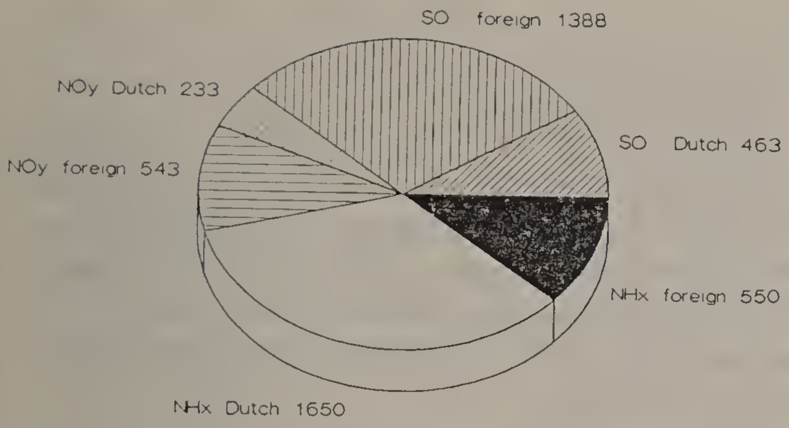

Fig 1. Dutch and foreign sources of acidification in The Netherlands (expressed in moles year^{-1} hectare^{-1}).

Agricultural activities

Agricultural activities, connected with the use and disposal of manure, are responsible for about 90% of the ammonia emissions mentioned above. Historical records exist for a period of over 100 years of the number of cattle in different parts of Europe. These data allow the reconstruction of the historical development of ammonia concentrations in Europe. Until 1950, the same levels of ammonia were observed in The Netherlands as elsewhere. However, intense agricultural developments in the country since then have resulted in much higher ammonia concentrations compared with the rest of Europe. This marked increase coincides with the onset of tree dieback. Severe tree dieback is observed near areas where intensive cattle farming takes place.

The effects of ammonium depositions on forest ecosystems are not yet completely understood, but recent investigations indicate that not only is general acidification a problem but also that high NH_4^+/K and NH_4^+/Mg ratios damage the roots of trees and upset biological cycles. Vegetation takes up most nutrients from the upper layer of the soil where ammonia is not yet converted to nitric acid. The uptake of nutrients at excessive ammonium to magnesium, calcium or potassium ratios is probably severely hindered. According to the latest estimates, the critical deposition limits for these ratios are reached at levels of 30% to 50% of the present deposition flux, depending on local circumstances.

Most of the air pollutants, deposited in The Netherlands are generally of foreign origin (Fig. 1). Ammonia is the exception: about 70% of the ammonia deposited in the sensitive areas of The Netherlands is of Dutch origin.

Conclusion

The conclusion must be that the severe pollution problems in The Netherlands, connected with ammonia, are primarily caused by Dutch activities. In other areas, where intensive cattle raising is taking place, similar phenomena could occur although they may not yet be recognized.

Sjaak Slanina is Chairman of the Commission on Atmospheric Chemistry. His address is: Netherlands Energy Research Foundation, ECN, PO Box 1, 1755 ZG, Petten, The Netherlands.

The geographic distribution and historical development of both soil acidification and ambient ozone concentrations in Europe do not correlate with the development of forest dieback.

Chemistry for life – 75th anniversary of IUPAC

IUPAC was formed in 1919. To celebrate its 75th anniversary, the Committee on Chemistry and Industry (COCI) is planning a series of national and regional activities on the theme 'Chemistry for life' during 1994. The outline of these activities on the facing page is based on Albert Fischli's presentation to Bureau and Council at the Lisbon General Assembly in August 1993. Fischli is COCI Chairman and IUPAC Vice-President for 1994–95.

A series of national and regional events on the theme 'Chemistry for life' will take place in 1994 on the occasion of the 75th anniversary of IUPAC.

Events at the national level

Important steps have been taken since the IUPAC General Assembly in Hamburg in 1991 to guarantee that events will take place in 1994 in all COCI countries under the general heading 'Chemistry for life'. Each country is free to select and organize an activity which best satisfies local interests and demand. The overall aim of these activities is to present, under the 75th anniversary of IUPAC flag, an objective picture of science and industry to the general public.

COCI envisages that the following countries will participate in these activities during 1994: Belgium, Canada, China – Beijing, China – Taipei, France, Germany, Italy, Japan, Netherlands, Nordic countries, Russia, South Africa, Switzerland, UK and USA.

The following are examples of some of the proposed activities:

China – Beijing: One day symposium in Shanghai, in June 1994 with participants from Academia Sinica, Shanghai Research Institute of Petrochemical Technology, Shanghai Petrochem Co. Ltd., pharmaceutical plants, the East China University of Science and Technology.

Germany: Forum at the General Assembly of the Gesellschaft Deutscher Naturforscher und Aerzte. The following speakers have been invited: Jean-Marie Lehn 'Supramolecular chemistry'; Hans-Jürgen Quadbeck-Seeger 'Chemistry for the future'; Dietrich Henschler 'Health hazards of toxicants'.

Japan: The dream of chemistry in the 21st Century, August, with participation of about 500 high school students and universities in Kyoto, Nagoya, Osaka and Tokyo. This event will include, for example, experiments on: lasers in chemistry; intelligent materials; C-60; insertion of DNA into cells; and high temperature superconducting materials.

Netherlands: National Day for Chemistry, September, involving Dutch universities and industrial laboratories. There will be a special event on Dutch television.

Switzerland: *see below.*

UK: Education video on 'A day in the life of ...' Royal Society of Chemistry 3 day course for high school teachers with an opening lecture on 'IUPAC – 75 years'; Evening lecture on 'Chemistry, achievements and challenges'.

USA: American Chemical Society, Division of History of Chemistry, special symposium, Washington DC, August; Special reception at the National Academy of Sciences, Washington DC organized by the Office of Awards and International Activities along with the National Research Council.

Regional events

Regional events are planned for Europe, North-America and the North-West Pacific Rim. Each event will consist of a one day symposium with an audience of journalists. Speakers will include Nobel prize winners, chief executive officers and government ministers concerned with ecology, economy and education.

The European event will take place in Brussels, Belgium in May 1994. This will be a joint CEFIC–IUPAC event. CEFIC is the Conseil Européen des Fédérations de l'Industrie Chimique (European Chemical Industry Council).

The North-America event will be held in the USA and a North-West Pacific Rim event is planned to take place in Taiwan.

Further details of both national and regional events will be published in forthcoming issues of *Chem. Intl.*

75th IUPAC anniversary celebration in Switzerland

The Swiss Committee for Chemistry has decided to mark the 75th anniversary of IUPAC by organizing a meeting for high school students from all parts of Switzerland. This meeting will take place during the weekend of 24–26 September 1994 in the Chemistry Department of the University of Fribourg and will be named 'Chemistry Festival 1994'.

A Festival Committee, consisting of teachers, students from high schools and universities and delegates from chemical industry, proposes to invite about 100 students – approximately one from each high school in the country. During Saturday afternoon, students will have the opportunity of participating in workshop activities such as:

- Building a boat propelled by carbon dioxide gas produced by a chemical reaction
- Creating an original shirt coloured by ink chromatography on cotton
- Plating a nickel coin by electrolysis
- Making pills from citric acid and sodium hydrogencarbonate to take home
- Filling balloons with helium to simulate atoms and connecting these to form 'molecules'.

On Sunday a conference will be held. The programme will feature contributions from eminent scientists including Nobel Prize winners. Conference topics will include historical aspects such as the life and work of Lavoisier (1993 marks the 200th anniversary of his death). There will also be presentations on chemical activities for youth, for example the Chemistry Olympiads and Science Youth Festival. Group discussions will be organized around important themes such as the role of chemistry in the present world, and the young person's vision of the role of chemistry in life tomorrow.

At the end of the conference, a show entitled 'Fire and fun' will be presented by a team of university teachers from the University of Fribourg.

Since Switzerland is a multilingual country, all activities will be presented in both French and German and possibly other languages.

Festival organizers would be interested to hear from other countries organizing similar celebrations.

Maurice Cosandrey
CH-1131 Tolochenaz
Switzerland

Chemistry at UNIDO

Programmes of UNIDO's Chemical Industries Branch aim to maximize the beneficial impact of chemical industries on the quality of life in developing countries. At the same time, they aim to ensure 'ecological sustainability of industrial development' (ESID) by minimizing adverse environmental effects and conserving energy.

The United Nations Industrial Development Organization (UNIDO) is the specialized agency responsible for the promotion and acceleration of industrialization in developing countries. Through technical cooperation, policy advice, investment promotion and technical support services, UNIDO assists both governments and the private sector in developing countries to strengthen their industrial base. Currently, UNIDO also cooperates with eastern and central European countries in their industrial restructuring efforts.

UNIDO is committed to ecologically sustainable development. Recently, it was named an implementing agency of the Montreal Protocol, and is expected to play a key role in the implementation of Agenda 21.

The Organization was established on 1st January 1967 and became the 16th specialized agency of the United Nations on 1st January 1986. Its mandate was to act as the central coordinating body for industrial activities within the United Nations system and to promote industrial development and cooperation at global, regional, national and sectorial levels.

The UNIDO Headquarters is located in Vienna, Austria. As of 31 December 1991, the Secretariat had 1386 multidisciplinary staff. Out of 464 professionals, 96 were women. The Director-General is Mauricio de Maria y Campos (Mexico).

UNIDO
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Mauricio de Maria y Campos became Director-General of UNIDO on 1st April 1993. Before then he was Vice-Minister for Industrial Development, Ministry of Trade and Industry, Mexico (1982–88); Executive Vice-President, Banco Mexicano SOMEX, Mexico City (1989 – May 1992); and Deputy Director-General, Department of Industrial Operations, UNIDO (July 1992 – March 1993).

Information on UNIDO

If you would like more information on UNIDO and its programmes, please contact:

UNIDO
Head, Public Relations and Information
PO Box 300
A-1400 Vienna
Austria

UNIDO's Constitution calls on the Organization to 'assist in the formulation of development, scientific and technological programmes and plans for industrialization in the public, cooperative and private sectors'. This gives the Organization a unique advantage, allowing it to draw on a broad spectrum of industrial cooperation. New partnerships with industry and companies are being fostered, making state-of-the-art expertise more readily available to developing countries.

The Medium-Term Plan sets out UNIDO's priority activity areas:

- human resource development
- development and transfer of technology
- industrial rehabilitation and modernization
- small- and medium-scale industries
- environment and energy.

They address three common themes:

- mobilization of financial resources for industrial development
- economic cooperation among developing countries and subregional industrial cooperation
- integration of women in industrial development.

Statistics published by UNIDO for the year 1991 indicate the scale of its accomplishments. In 1990–91, UNIDO delivered technical assistance of some USD 307 million, a growth of 60% from the USD 194 million delivered during UNIDO's first two years (1986–87). In 1990–91, the Organization also successfully promoted USD 1.6 billion worth of investment projects, four times greater than the USD 371 million promoted in 1986–87. Project approvals under the trust fund scheme, an innovative alternative to traditional financing, rose from USD 3.7 million in 1987 to more than USD 41 million in 1991, that is, about 31% of UNIDO's total approvals.

In 1991, 1927 technical cooperation projects were either implemented or under implementation with a total value of USD 151 million. Of these, 212 projects (11%) were valued at USD 1 million or more; 637 projects (33%) were between

UNIDO Headquarters, Vienna.

USD 150 000 and USD 1 million; and 1078 (56 %) were below USD 150 000.

UNIDO employs an average of 2000 experts a year. In 1991, it awarded contracts to the value of some USD 19 million, placed equipment orders worth USD 36 million and carried out training valued at USD 18 million.

Demand is growing for UNIDO's technical support activities, which include training, policy advice on economic and industrial planning, industrial statistics, in-depth studies and research. For example, INTIB, UNIDO's Information and Technological Information Bank, offers a combination of on and off-line information, access to databases and publications, compiled and repackaged information, answers to industrial inquiries, and technical assistance to strengthen industrial and technological information systems in developing countries.

UNIDO's five Departments, each headed by a Deputy Director-General, are responsible for: Programme and Project Development; Industrial Operations; Industrial Promotion, Consultations and Technology; External Relations, Public Information, Language and Documentation Services; and Administration.

Funding

The main sources of financing UNIDO's technical assistance activities are the funds allocated by the United Nations Development Programme (UNDP), for which UNIDO acts as an executing agency. These funds are allocated to each developing country and region and normally programmed in cycles of 5 years.

The Industrial Development Fund (IDF) consists of voluntary contributions from governments and nongovernmental organizations (including private enterprises) in local nonconvertible and convertible currencies directly pledged to UNIDO. The IDF was created to finance innovative, nontraditional industry-related projects of a pilot character with relevance to a large number of countries and with priority given to projects which will have a multiplier effect. Activities are restricted by the low general purpose convertible contributions. Special purpose contributions are, however, provided by donors for specific projects.

UNIDO has taken a new initiative to include Special Trust Fund schemes as part of the special programmes and activities of the organization. The funds required for each project come either from the beneficiary of the UNIDO assistance in the developing country (in which case it is called a self-financed trust fund project) or from a third-party donor, which may be a development finance institution, a governmental or nongovernmental donor agency, an individual or a group of companies, or industrial associations. The three major thrusts of the special trust fund programme are:

1 direct support of manufacturing plants in the developing countries for performance improvement, training, manpower development, maintenance and self-help programmes;

2 service to development finance institutions in designing, formulating and implementing selected industrial projects, particularly in rehabilitation of plants, small- and medium-industry development, indigenous entrepreneurial development, training and technical cooperation among development countries;

3 programme or project management service to donor agencies in the design, formulation and implementation of programmes on selected priority objectives, for example, integration of women in industrial development, enterprise-to-enterprise cooperation, procurement of goods and services, agroindustries and human resource development.

Chemical Industries Branch

UNIDO's Chemical Industries Branch is one of four branches of the Industrial Operations Technology Division, which is one of the Divisions of the Department of Industrial Operations. The other three Branches in this Division are: Agro-based Industries; Engineering Industries and Metallurgical Industries. Dr Tcheknavorian-Asenbauer is Officer-in-Charge and Deputy Director-General of the Department of Industrial Operations.

Projects of the Chemical Industries Branch cover a wide range of industries: petroleum refineries and petrochemical industries; pharmaceutical industries; agrochemical industries; cement, lime and concrete building materials; nonmetallic minerals, ceramics, glass and building materials; energy and environment; and biotechnology. The Branch is involved in all phases of its technical cooperation projects, that is: project identification; techno-economic cost benefit analysis; project design; project document formulation; and project execution. Depending upon the complexity of the project, costs may vary from USD 10 000 or less to several million dollars.

Archalus Tcheknavorian-Asenbauer.

Balasubramanyan Sugavanam, Chief of UNIDO's Agro-Chemical Industries Unit at the IUPAC Workshop on Safety in Chemical Production held in Basel.

The main activities of the Branch programme include:

- Fielding industrial experienced senior staff members to diagnose the cause of problems occurring in various parts of the chemical industry and make unbiased recommendations. These staff missions are undertaken by a staff member alone or with the assistance of outside specialist consultants;
- Fielding teams of experienced experts to diagnose the cause of problems in industry and to advise Governments on process and technology selection and the conditions for the transfer of technology and industrial project implementation;
- Holding seminars with participation of international reputed experts to advise the local chemical industry on how to overcome their existing problems, and inform them of useful and potentially profitable ways of expanding the local industry;
- Technical assistance projects to existing companies and institutions to assist them in developing new capabilities, new technologies, new products and applications for such products;
- Establishing new training and development institutions.

UNIDO's Chemical Industries Branch has cooperated with IUPAC in, for example, the IUPAC Workshops on Safety in Chemical Production. The first of these Workshops was held in Basel, Switzerland in September 1990 (see *Chem. Intl.* **13,** 50–60 (1991)). Participants included 50 scientists from 22 developing countries of whom 11 were sponsored by UNIDO. Dr Sugavanam, Chief of UNIDO's Agro-Chemical Industries Unit, attended the Workshop. UNIDO presented two papers at the Workshop and contributed to the discussion panels. As another example, Dr Tcheknavorian-Asenbauer presented a paper at the CHEMRAWN VII World Conference on Chemistry and Sustainable Development which took place in Moscow, Russia, in September 1992 (see *Chem. Intl.* **15**, 41–47 (1993))

The chemical industry

In the introduction to the document (published February 1993) on UNIDO's chemical industries technical assistance programmes, Dr Tcheknavorian-Asenbauer writes that chemicals are essential to virtually all industries and to agriculture even though the chemical industry is often mistakenly associated with capital-intensive petrochemical complexes and the use of potentially dangerous and environmentally hostile processes and thus considerably unsuited for developing countries.

However, she points out, chemicals are needed for pharmaceuticals and medicines, housing and shelter, textiles and clothing, food production and food conservation, printing and communications. They are just as essential for developing as for industrialized countries. Chemical products, such as soaps and disinfectants also play a role in improving public hygiene and thus in increasing life expectancy and the quality of life.

Not having a chemical industry can severely handicap a country's industrial development. It will have to pay a much higher price for the chemicals it needs than does a country with an efficient chemical industry. The costs of imported basic chemicals such as acids, alkalis, chlorine for water purification, fertilizers, solvents for paint manufacture, formaldehyde for resin manufacture, lubricating oils and insulating materials are often far higher than the costs of making products locally and may be twice as high as in industrialized countries. This can put an insurmountable hurdle in the way of the development of quite simple industries which, with low labour costs, could be otherwise quite profitable.

For those countries fortunate enough to have a chemical industry it is essential that it does have a positive impact on the country's development. This means:

1 Promoting the growth of industries which use the products of the chemical industry by encouraging and assisting their appropriate and efficient use;

2 Ensuring the competitive operation of the chemical industry itself, that is, making available the training of operators, engineers and managers and establishing well run libraries with databases. Also carrying out trouble shooting, and revamping or modernizing simple plants to maintain efficient operation;

Pigment laboratory in Mongolia.

Two examples of recent UNIDO projects

Toxicology Research Centre in the Republic of Korea

A 3-year project has been carried out to assist the Republic of Korea in setting up a Toxicology Research Centre at Taejeon near Seoul. The Centre will give the country the capability of carrying out toxicological evaluations of chemicals for various outlets according to international standards.

Funded by UNDP (USD 400 000) and the Government of the Republic of Korea, UNIDO assisted in designing the centre, providing high level advisory and training services in animal breeding, general toxicology, mutagenicity, teratogenicity, aquatic toxicology and collection and interpretation of laboratory results.

The project has now entered the second phase and the Centre is considered as one of the well equipped and staffed toxicology centres in Asia. The Centre is already carrying out contract work for Korean industries and government institutions under Good Laboratory Practice (GLP) regulations.

The Toxicology Research Centre, Taejeon, Republic of Korea.

Pesticide Formulation Plant at Hwambi, Myanmar.

Pesticide Formulation Plant in Myanmar (Burma)

Since 1985, UNIDO has assisted in establishing a pesticide formulation plant in Myanmar for the production of emulsiable concentrates (EC) for use in agriculture. The plant is already in full operation and has all the facilities to scrub the vapours emitted by the plant, drum crushing unit, waste-water treatment and a quality control laboratory. A high temperature (1200°C) incinerator will be installed soon. Capability has been established to introduce locally available solvents instead of imported solvents. The plant is located in Hwambi, about 50 km from Yangon.

3 Ensuring that the chemical industry, and those industries using its products have a positive environmental impact and are operated safely.

The severe negative impact on the development of many developing countries without an adequate chemical industry could be reduced in many ways, according to Tcheknavorian-Asenbauer. One way would be to investigate the possibility of setting up of chemical industry operations which are economical even if carried out on a small-scale. Among these are:

1 the formulation and packaging of pharmaceuticals and pesticides, and production of some of the ingredients;
2 the manufacture of drugs and medicines;
3 the chemical related industries, such as soap, cleaning preparations and cosmetics; and
4 the plastics products industry.

Developing countries can also be helped to improve the efficiency of chemical use by encouraging recycling, efficient product design and efficient plant operation, suggests Tcheknavorian-Asenbauer. If it is profitable to use a labour-intensive process for cleaning and recycling plastic waste in an industrialized country, it is far more worthwhile in a developing country.

The Chemical Industries Branch has six units: Agrochemical Industries; Cement, Lime and Concrete Building Materials; Energy and Biotechnology; Non-Metallic Minerals, Ceramics, Glass and Building Materials; Petroleum Refineries and Petrochemical Industries; and Pharmaceutical Industries. The following is a brief description of the aims and activities of a small sample of the projects operated by Units of the Chemical Industries Branch.

Petroleum refineries and petrochemicals

In addition to providing technical assistance to the petroleum refining and petrochemical producing industries *per se*, this UNIDO programme covers both related industries such as the treatment and use of natural and associated gas to produce petrochemicals, and the transformation of petrochemical intermediates such as monomers, and products such as polymers into useful end-products such as detergents, paints, plastic articles, elastomers, synthetic fibres and carbon fibres. Also covered are the development of new applications for petrochemical products such as the use of plastics in agriculture, the ecologically sustainable industrial development aspects of the production and use of such products. This includes plastics recycling, elimination of the use of volatile organic compounds for the production of paints and the use of naturally renewable products, oils, fats and resins, as substitutes for petrochemicals in the production of detergents, resins and paints.

Examples of projects quoted in the Branch's February 1993 review are:

- Evaluating the performance of a country's detergent industry so as to recommend measures to be taken to improve yields and product quality;
- Surveying the operation of a synthetic fibre company and recommending how to optimize capacity utilization and improve product quality;
- Surveying a country's synthetic fibre and textile industry so as to formulate a project aimed at increasing the utilization of synthetic fibre cotton blends and the quality of products made using such blends;
- Diagnostic survey of factories in both the public and private sector of a country's plastics transformation industry to recommend measures to be taken to improve product quality;
- Efficient utilization of plastics and new product development;
- Diagnostic survey of a country's petrochemical and polymer producing industry to determine if the industry is being operated correctly.

In the final example above, a country which is producing very large quantities of bulk petrochemicals, and polymers in a joint venture with major multinationals, was concerned that as annual throughputs considerably exceeded initial design capacity, the plants might be operated in a way which could shorten their useful life.

UNIDO was chosen as a source of unbiased advice on this matter and in a 3-week mission a senior staff member visited numerous plants in the country and held discussions with the people running these plants. As a result it was possible to provide the country's Government with the explanations as to why the plants were operating in excess of their design capacity and provide reassurance that this would not endanger the plants, or reduce their useful life. The unbiased report was useful both to the country as well as to good relations between the country and its multinational joint venture partners.

Pharmaceutical industries

UNIDO's pharmaceutical industries technical assistance programme has as its major thrust the building of indigenous capability for the production of the most important drugs required in a country. The intention is to serve the health requirements of the most needy and provide a source of supply to the largest possible segment of the word's population. This implies the production of essential drugs by the public and private sectors of the pharmaceutical industry in developing countries.

Since essential drugs provide only low margin profits it is difficult for developing countries to reach economy of scale. Therefore UNIDO's idea is to promote a mixed products approach. By production of a few special products of low tonnage but high margin profits, such as pharmaceutical specialities and a variety of health care products and cosmetics in multipurpose and multiproduct plants in addition to the essential drugs, financial viability can be achieved. The impact of this technical assistance programme, that is application of a mixed product approach, should not only be evaluated in terms of cost effectiveness, but also in terms of benefits gained by saving human lives, raising healthy children and creating a more healthy society.

Approximately 75% of the world's population live in developing countries yet the share of the global consumption of pharmaceuticals in these countries is less than 25%. To help meet this challenge, UNIDO's technical assistance programme in the pharmaceutical industries has developed a series of comprehensive projects in three areas of importance:

- the pilot scale organochemical synthesis of pharmaceutical chemicals in multipurpose plants by technology transfer and cooperation with well established pharmaceutical industries;
- the industrial utilization of medical plants used in traditional therapies which ostensibly, over the years, have sustained the health care efforts of efforts of 80% of the world's rural population;
- the industrial production of biologists to assist developing countries in strengthening the existing production facilities for vaccines and creating additional capability.

A UNIDO expert (left) advises on drug formulation at a pharmaceutical plant in Zanzibar.

India: UNIDO Workshop on Pesticide Formulation Technology and (right) Pesticide Development Centre, New Delhi.

Fertilizers and crop protection agents

UNIDO's fertilizers and crop protection agents technical assistance programme focuses on the safe and effective development of fertilizers and crop protection agents (pesticides) in developing countries taking into account the closed and confidential nature of the technology know-how especially in crop protection agents. Every effort is made to meet the challenge of making these chemicals safer, user and environment-friendly and to take steps for an overall reduction in their use through an integrated approach and without any reduction in efficiency.

Today both industries for fertilizers and crop protection agents are faced with stringent safety controls. There is an urgent demand to control and reduce environmental risks especially effluents/emissions, groundwater contamination, residues in soil and food crops and the excessive use of toxic chemicals. The recent developments in fertilizer and crop protection agents technology in production, formulation and application have not yet reached many developing countries where still obsolete technology is applied. Also the use of hazardous chemicals and products that are banned or restricted in developed countries create health risks both for workers and end users. UNIDO's projects on fertilizers and crop protection agents aim to maintain public health standards for the fast growing population and take into account the stringent requirements for human and environment safety.

The projects in this programme aim at: policy issues and market analysis; import substitution; technology transfer; pilot scale operation; good manufacturing practice; quality and safety; research and development; institution building for establishing demonstration plants and centres of excellence in specialized fields.

These project aims are directed at the following areas:

- mineral fertilizer productions (macro-nutrients)
- nitrogen
- phosphate
- potassium
- organic fertilizers
- organic/mineral fertilizer mixtures
- micro-nutrients
- crop protection agents (pesticides) insecticides, fungicides, herbicides, rodenticides, bio/botanic crop protection agents, plant growth regulators
- safety in chemical production
- effluent control/waste management
- ecotoxicology.

Cement and lime

The technical assistance programme in the cement industry focuses on developing local skills and capabilities in order to eliminate the need for continuing assistance to routine maintenance and operation of equipment. The cement programme provides technical advice and gives development support to the cement industry in developing countries, either directly or in cooperation with other UNIDO programmes.

Cement kilns are recognized as safe and effective digesters of various types of combustible industrial waste. Many cement factories in developing countries are, however, not suitable for burning waste because their present operation is not well controlled and the excessive emission of long travelling dust and fumes practically prevent their taking part in recycling. Therefore, the technical assistance programme in the cement industry is engaged in promoting clean and environment friendly operation of cement plants as well as promoting the use of waste fuels which eventually would help to conserve virgin fuel.

UNIDO is still only at the initial stage of promoting small industrial lime installations, as an alternative to traditional technology. Modern industrial installations on a small scale save energy, reduce pollution and produce lime of the same quality as state-of-the-art large-scale industrial plants.

The application of pozzolanic materials or the promotion of lime-pozzolanic binders is seen as an important contribution to protect the environment, and the development is being promoted with the technical assistance and dissemination of information whenever possible.

Nonmetallic mineral based industries

This programme focuses on promoting and optimizing the use of domestic nonmetallic minerals for ceramics, glass and building materials industries. Nonmetallic minerals account for the major part of the value of global nonfuel mineral production use in manufactured goods as well as in construction, agriculture and environmental protection. They are nonrenewable resources including essential minerals which are threatened by depletion, if not appropriately managed.

A programmatic approach to the overall planning of nonmetallic minerals exploitation integrates development of a wide range of production technologies and makes optimum use of locally available raw materials. This basic principle implies that close linkages between the various programmes of the sector such as ceramics, glass, building materials and handicrafts are specifically encouraged and that efforts are made at all stages of project development to ensure full use of all grades of material coming out of the same deposit. This policy has also strong environmental implications in terms of proper resource management, including low waste mining and manufacturing technologies as well as promotion of environmentally sound mining techniques and plans up to the final phase of mine reclamation and landscape recovery.

Nonmetallic minerals can be subdivided into three categories:

1 Low-value commodities – construction materials, including sand and gravel, crushed stone, clays, limestone and cement which are produced and consumed in very large annual quantities;

2 Medium-value, medium-volume which includes the principal fertilizer and chemical minerals such as salt, phosphate, sulfur, potash and soda ash;

3 High-value, low-volume category of industrial minerals which includes a large variety of commodities with different end-uses. This multiple-use industrials category includes commodities such as talc, barrite, fluorspar, asbestos, feldspar, graphite, mica and many others. In terms of unit value and quantities consumed, this category is comparable to the major metals.

The radius of economically viable trade grows with increasing unit value. Building materials are therefore normally produced for local consumption while higher value minerals even in their crude state can be exported.

Pilot plant for scientific glass ware in Vietnam.

Ceramic Technological Institute in Bangalore, India.

UNIDO's strategy is to promote efforts which will assure a maximization of the local value added component. Increasing the local processing activities which, especially in the framework of a broad range of manufacturing industries, will also reduce import dependence and promote an integrated mineral use that eliminates inefficiency and wastage in mineral exploitation.

Biomass and energy

The biomass energy field is vast. Activities of UNIDO's programme therefore cover only a limited number of areas.

The development of alternative sources for charcoal production to relieve the current pressure on the environment is an example of one of the projects in this programme. In most developing countries charcoal forms the main fuel for cooking in urban and suburban areas. The increasing demand for this product is one of the main causes of the continuing deforestation in these countries. This situation has created the need for developing alternative sources for charcoal production and one of the options is the use of agricultural residues. In some countries, residues are burned directly after harvesting to prevent uncontrolled fires and diseases.

UNIDO has recently successfully developed a process for the production of briquettes from cotton stalks. The process, which uses equipment which can be constructed and maintained locally, involves carbonization, grinding and subsequent agglomeration of the produced charcoal fines with a suitable binder which is also from a local agro-processsing waste. A plant using this technology is present in operation and produces briquettes with a marketable quality. There is a clear demand for the briquettes produced.

Other biomass and energy projects include:

- Introduction and development of biomass energy systems for local heat and power supply;
- Use of rice hulls for energy;
- Production of charcoal briquettes;
- Development of environmentally sound coal conversion processes;
- Reduction of sulfur compounds emissions.

Biotechnology

UNIDO's biotechnology programme covers several major areas. The production of chemicals and biochemicals is one such area. This includes: citric acid production; enzyme production; production of plastics from sugar cane via ethanol fermentation; production of high value fragrance ingredients from natural compounds by biotransformation using plant cell culture; production of industrial chemicals from indigenous carbohydrate raw materials. The programme also has a project on process development for microbial pesticide production.

Energy is another area on which the biotechnology programme focuses. One project involves the construction of demonstration biogas plants treating various industrial wastes for evaluation of technical and economic viability and dissemination of the results. Others include enhancing institutional capability in the development and promotion of biogas technology and a project on ethanol production from renewable biomass sources.

The composting of municipal solid wastes is an important area of this programme. Projects include: assessment of the viability of composting selection and adaptation of appropriate composting process; assistance with the design and construction of composting plants; training in the operation, repair and maintenance of composting plants; marketing of compost.

The programme is also active in biochemical engineering. Activities include the development of novel bioreactors for specific process and membrane technology for water purification and downstream processing.

The final area of interest in the biotechnology programme is industrial waste water treatment – especially the following activities:

- in-factory waste audits to reduce waste production at source;
- industrial discharge and ambient monitoring;
- analysis of effluents;
- planning of industrial development with regard to environmental aspects;
- regulation and control of factory discharges;
- appropriate waste treatment processes.

Pulp and paper

UNIDO's technical assistance programme in pulp and paper focuses on improving existing mills and the development, adaptation and transfer of appropriate technologies related to pulping and paper-making. Special emphasis is attached to indigenous and nonwood fibrous raw materials utilization, introduction of clean technologies, abatement of pollution, water and energy savings and waste paper utilization.

This regional project on biotechnology in Latin America is an example of a joint UNIDO–UNESCO project.

The programme is operating in the following areas:

- fibrous raw material collection and preparation;
- pulping and pulp bleaching;
- black liquor chemical recovery and lignin utilization;
- paper-making (different grades of paper and board);
- handmade paper-making;
- chemical additives for pulping and paper-making;
- waste paper utilization;
- pollution control and abatement.

One of the projects in this programme is concerned with the development of a desilication pilot plant for bamboo kraft lignin. Nonwood fibrous raw materials such as straw, bagasse and bamboo normally have higher ash and silica content than wood. Most of the silica dissolves during cooking and remains as an undesirable component in the black liquor. The presence of silica is a technical barrier to the efficient recovery of nonwood black liquor. This, together with economic barriers, is one of the reasons why most of the small- and medium-sized nonwood pulp mills in developing countries do not have any chemical recovery and thus severely polluted rivers/waters.

UNIDO's technical assistance is delivered in order to develop a process for desilication of nonwood black liquor to be used in small- and medium-sized pulp mills. The process is developed on a laboratory scale and subsequently a demonstration plant is installed in, for example, a bamboo/reed pulp mill. One such pilot plant has been in operation since 1989.

Ecologically sustainable industrial development

UNIDO's Medium Term Plan for 1994–1999 states that the objectives of the environmental and energy programmes of UNIDO are to ensure the ecological sustainability of industrial development and to maximize the beneficial impact of industry on the quality of life by minimizing its adverse environmental effects, while conserving energy through its recovery and recycling, as well as the generation and utilization of renewable sources of energy.

The activities of UNIDO in the environmental sector and in the promotion of ecologically sustainable industrial development (ESID) are governed by four basic considerations. First, the recognition that key roles exist for governments, industry, international organizations and others in achieving ecologically sustainable industrial development. Secondly, the mutuality – interests between developed and developing countries in achieving ecological sustainable industrial development – provides a compelling argument for North–South cooperation and for supporting South–South cooperation. Thirdly, many cost-effective measures for reducing threats to the biosphere that are possible in the South will not take place unless the North extends its technical cooperation (transfer of knowledge and expertise) and its financial assistance to the South. Fourthly, managing the transition to an ecologically sustainable economy should involve all sectors of industry and should be the basis of clear targets, appropriate timeframes and financial incentives to support the transition process.

In keeping with the six priority areas identified at the ESID Conference in October 1991, UNIDO provides assistance in: (a) building up the technical and scientific institutional capacity to develop, absorb and diffuse pollution prevention techniques, cleaner production processes and CFC-substitution production techniques; (b) implementing international environmental conventions and protocols related to industrial activities; (c) determining the environmental soundness of industrial technologies; (d) integrating environmental considerations into industrial strategies and policies; (e) identifying appropriate financial resources which could be utilized for the achievement of ESID; and (f) strengthening existing databases and disseminating technical and policy information on ecologically sustainable industrial development.

In the field of energy, UNIDO concentrates on providing assistance to developing countries in industrial energy development and power generation employing all feasible alternative sources of energy so that developing countries can industrialize at reasonable levels of per-capita energy consumption and with acceptable environmental consequences. This is accomplished by: (a) increasing awareness of management/government of energy options in developing countries: (b) providing technical support to developing countries' infrastructures, including the establishment of industry-related research and development institutions, the introduction of new and alternative technologies and the establishment of maintenance and repair capabilities: and (c) enhancing the Organization's capacity to support the transfer of technology through seminars to ensure currency in technology issues and the recruitment of replacement UNIDO staff having experience with advanced energy technologies. The energy related efforts of the Organization will not introduce any major new elements

Geothermal complex at Olkaria, Kenya. One of the objectives of UNIDO's environmental and energy programmes is to minimize adverse environmental effects.

UNIDO's programmes include the establishment of maintenance and repair capabilities.

to the ongoing activities: instead, the intention is to maximize the efficiency and impact of UNIDO in this field.

The methodology employed to accomplish these objectives includes: (a) focusing on technologies or options where existing indigenous markets are least able to develop the solutions; (b) identifying and promoting technology options that optimize output per unit of energy used in industrial processes using, *inter alia*, technological information and UNIDO databases; (c) emphasizing those projects with the most promising short-term prospects for commercialization; (d) concentrating on methods for more systematically demonstrating and promulgating energy technologies in order to maximize the 'multiplier' or 'demonstration' effects; (e) factoring realistic energy cost projections into feasibility studies for both energy conservation and technology transfer projects; and (f) integrating environmental considerations into energy projects. UNIDO continues to work with UNEP (United Nations Environment Programme) and other organizations in the United Nations system to avoid duplication and enhance efficiency.

Summary

UNIDO aims to promote and accelerate industrial development in developing countries and to promote industrial development and cooperation on global, regional, as well as sectorial levels. UNIDO is unique among the United Nations agencies: its mandate is specifically to assist in the formulation of development, scientific and technological programmes and plans for industrialization in the public, cooperative and private sectors.

UNIDO pays special attention to: human resource development, development and transfer of technology, industrial rehabilitation; small- and medium-scale industries, environment and energy (especially the ecological sustainability of industrial development), mobilization of financial resources for industrial development; promotion of cooperation between developing countries; and industrial safety.

The Chemical Industries Branch has six units: Agrochemical Industries; Cement, Lime and Concrete Building Materials; Energy and Biotechnology; Non-Metallic Minerals, Ceramics, Glass and Building Materials; Petroleum Refineries and Petrochemical Industries; Pharmaceutical Industries. The Branch is involved in all phases of technical cooperation projects: project identification; techno-economic cost benefit analysis; project design; project document formulation; and project execution.

This article was prepared by CI *Editor Mike Freemantle. It is largely based on extracts from documents and publications made available by UNIDO and also on discussions with staff at the UNIDO Secretariat in Vienna. The Editor is pleased to acknowledge the cooperation of UNIDO and in particular the invaluable assistance of Dr A. Tcheknavorian-Asenbauer (Head, Chemical Industries Branch) and Dr B. Sugavanam (Chief, Agrochemical Industries Unit). The Editor is also grateful to UNIDO and UNESCO for the provision of photographs used to illustrate this article.*

Discovery of the transfermium elements

Parts II and III of the Report on the Discovery of the Transfermium Elements prepared by the joint IUPAC–IUPAP Transfermium Working Group were published in the August 1993 issue of *Pure Appl. Chem.* The issue also included responses on the report from the concerned laboratories in Berkeley, Darmstadt and Dubna.

In 1985 IUPAP (the International Union of Pure and Applied Physics) and IUPAC decided to establish a Transfermium Working Group (TWG) to consider questions of priority in the discovery of elements with nuclear charge number Z greater than 100. TWG membership was determined by the two Unions in 1987: IUPAC Members were Norman Greenwood (UK) and Yves Jeannin (France). Greenwood was President of the Inorganic Chemistry Division from 1977 to 1981 and Jeannin was President of the Union from 1989 to 1991.

A report highlighting some of the early discussions of TWG appeared in *Chem. Intl.* **11**, 180 (1989). The group met 7 times for approximately one week each, three of the meetings being in the laboratories of chief concern, namely those at Berkeley, Darmstadt and Dubna.

The work of the Group was carried out in two phases.

Phase (i), the establishment of criteria that must be satisfied for the discovery of an element to be recognized, did not concern itself with individual cases or with priorities; it was carried out in close consultation with laboratories. The report on Phase (i), which is Part I of the TWG report, was accepted by IUPAP and by IUPAC in 1990 and published in *Pure Appl. Chem.* **63**, 879–886 (1991). A note on this report was published in *Chem. Intl.* **13**, 213 (1991).

The report on **Phase (ii)**, the judgemental phase of the work of the Group, was accepted by the IUPAP Council in Madrid, September 1991, and approved for publication by the IUPAC Bureau in Hamburg, August 1991. This report forms Parts II and III of the TWG report. Both parts were published in the August 1993 issue of *Pure Appl. Chem.* Part II is entitled 'The introduction to discovery profiles' and Part III 'Discovery profiles of the transfermium elements'. Also published with Parts II and III are the responses from the concerned laboratories in Berkeley, Dubna and Darmstadt and the reply to the responses by TWG.

Yves Jeannin (left) and Norman Greenwood.

Contents of Parts II and III

II *Introduction to Discovery Profiles*
II.1 Introduction
II.2 Some Scientific Considerations
  II.2A Half-life determination
  II.2B Backgrounds due to target impurities
  II.2C Quantitative cross section experiments
  II.2D Cold fusion
  II.2E Reaction mechanisms

III *Discovery Profiles of the Transfermium Elements*
  Element $Z = 101$
    $Z = 102$
    $Z = 103$
    $Z = 104$
    $Z = 105$
    $Z = 106$
    $Z = 107$
    $Z = 108$
    $Z = 109$
    $Z = 110$
    $Z = 111$
    $Z = 112$
  Summary of TWG Conclusions
  Bibliography on Transfermium Elements

The publication completes the work of the Group by applying the criteria of Part I on an element-by-element basis; it considers and analyses all the pertinent literature and discusses in chronological and critical detail those papers considered important for the building up of confidence that each element has been put in evidence. This delineation of discovery profiles results, in some cases, in a sharing of the credit for discovery.

The TWG conclusions are listed in Table 1.

TWG has now ceased officially to exist and, as far as IUPAC is concerned, it is now up to the Commission on Nomenclature of Inorganic Chemistry to recommend actual names of the elements.

'Criteria that must be satisfied for the discovery of a new chemical element to be recognised – DISCOVERY OF THE TRANSFERMIUM ELEMENTS – Part II: Introduction to discovery profiles; Part III: Discovery profiles of the transfermium elements' being the report on the concluding phase (phase ii) of the operation of the Transfermium Working Group of IUPAC and IUPAC was published in Pure Appl. Chem. ***65**, 1757–1814 (1993). Responses on the report invited by TWG from Lawrence Berkeley Laboratory, California, Joint Institute for Nuclear Research, Dubna and Gesellschaft für Schwerionenforschung, Darmstadt, following by the reply to the responses by TWG were published in* Pure Appl. Chem. ***65**, 1815–1824 (1993).*

Table 1 Conclusions of the IUPAC–IUPAP Transfermium Working Group.

Element	*Conclusion*
101	Element 101 was discovered by the Berkeley group – with certainty in 1958 following strong indications in 1955.
102	Two 1966 (simultaneously published) Dubna results, both submitted in 1965, give conclusive evidence that element 102 had been produced.
103	An important step on the way to discovery of element 103 was made in 1961 by the Berkeley group although evidence fell short of full conviction, particularly in relation to the cross section curve. Dubna papers published in 1965, 1968 and 1970 approached effective certainty; but it was not until a Berkeley paper in 1971, which confirmed earlier Berkeley and Dubna work, that it could be said that all reasonable doubt had been dispelled. In the complicated situation presented by element 103, with several papers of varying degrees of completeness and conviction, none conclusive, and referring to several isotopes, it is impossible to say other than that full confidence was built up over a decade with credit attaching to work in both Berkeley and Dubna.
104	Chemical experiments in Dubna, reported in 1969 and 1970, and Berkeley experiments, reported in 1969, were essentially contemporaneous and each show that element 104 had been produced. Credit should be shared.
105	Independent work, reported in 1970, from Berkeley and from Dubna, was essentially contemporaneous and equally convincing. Credit for the discovery should be shared.
106	Independent work, reported in 1974, from Berkeley-Livermore and from Dubna was essentially contemporaneous. The Dubna work is highly important for later developments but does not demonstrate the formation of a new element with adequate conviction, whereas that from Berkeley-Livermore does.
107	Darmstadt work, published in 1981, provides convincing evidence for the formation of element 107. The proceeding Dubna work, reported in 1976, reports events with $Z = 105$ which quite probably were due to the formation of element $Z = 107$; yet, taken alone, this work does not give sufficient confidence that element $Z = 107$ was in evidence.
108	The formation of element 108 was established by simultaneous and independent work in Darmstadt and Dubna, reported in 1984. The work in Darmstadt is more detailed and, of itself, carries conviction. In retrospect, the Dubna work taken together with cross section measurements in Darmstadt leaves little doubt that element 108 was produced and was inferred with confidence through identified descendants following a satisfactorily understood decay path. The major credit should be accorded to Darmstadt.
109	The Darmstadt work, reported in 1982, gives confidence that element 109 has been observed.
110	The Dubna experiment, reported in 1987, describes interesting preliminary work but is insufficient to give confidence that element 110 has been produced.
111	No data indicating formation of element 111 are available.
112	Data reported so far are insufficient to indicate that a new element has been produced.

Secretary General's Column

Gerrit den Boef

In his report of the Lisbon General Assembly, Secretary General Gerrit den Boef comments on the elections, scientific activities and restructuring of the Union.

Introduction

This column is devoted to the main events of the General Assembly which was held in Lisbon, Portugal's capital, during 5–12 August 1993.

First it is appropriate to thank once more our Portuguese hosts who did a very fine job in providing us with conditions in which all bodies of the Union could work under very comfortable circumstances.

Although the Union is about science, it is inevitable that time is spent on the necessary administrative and financial business, enabling it to perform properly during the coming biennium. Let me therefore start with some of the main points of that part of the assembly.

Elections

In all bodies of the Union, new officers had to be elected who will run IUPAC from 1st January 1994 for a period of two years. The present officers continue until that date.

Allen Bard will have completed his term as president by then. He has shown that a period of two years can be sufficient to bring the realization of innovative ideas on the performance of the Union a substantial step forward. He chaired meetings in a friendly manner and with great skill, and it was for his fellow officers a great pleasure to work with him.

Normally Vice-President Heinz Staab would have been his successor but unfortunately he is now unable to assume the presidency. The Union is very lucky that Kirill Zamaraev is prepared to take up the presidency without an introductory term as vice-president. His experience as a division president and a member of both the Bureau and the Executive Committee, seems a guarantee that he will be able to undertake successfully his duties as president of the Union without having been vice-president. He was elected by Council with a large majority of votes.

Albert Fischli.

The same applies to Albert Fischli, who was elected as vice-president, to become president of the Union during the 1996–97 biennium. It will be very good for the Union to have a president from chemical industry in the near future.

Allen Bard will continue for another two years as past-president, whereas treasurer John Ward and myself also complete our four-year term at the end of the next biennium.

Six vacancies existed for the new Bureau as elected members. Ron Brown (Australia) was re-elected for another term, whereas five new Bureau members were elected by Council for four years:

- David Eaton (USA)
- Edward Grzywa (Poland)
- Jack Lorimer (Canada)
- Leiv Sydnes (Norway)
- Cunhao Zhang (China)

After the Council meeting, the Bureau elected as members of the Executive Committee for the coming two years: Ron Brown, David Eaton and Joshua Jortner (Israel).

At the end of this calendar year (1993) we say farewell with gratitude for their work for the Union to Past-President Yves Jeannin, Vice-President Heinz Staab and the elected Bureau members, Mary Good, Wei-Yuan Huang, Shô Itô, Ingemar Wadsö and the retiring division presidents, Bob Alberty, Nelson Leonard and Walter Heitz. We welcome as division presidents and Bureau members Kozo Kuchitsu, Michinori Oki and Jim Economy.

At the General Assembly, a large number of new officers and commission members were elected. The names and addresses of officers of IUPAC bodies for the biennium 1994–95 were published in *Chem. Intl*, **15**, 215, (1993).

The Council looked very carefully at the difficult financial position as outlined by the treasurer and the Finance Committee, and agreed with the proposal to increase the national subscriptions by 5% in each of the years 1994 and 1995, in order to maintain the present level of activities.

IUPAC's scientific policy

As I noted at the start of this column, the Union is about science and it is a good thing to mention that this meeting devoted more attention to the scientific work of the Union in previous years.

Three items on the agenda gave Council the opportunity to discuss the scientific policy of the Union in the future:

- President's State of the Union Report
- Vice-President's Critical Assessment
- Report on Restructuring of the Union.

In his State of the Union Report, President Bard expressed his gratitude for the very valuable activities and

Kirill Zamaraev.

publications produced during the past biennium. At the same time, however, he pointed to the necessity for IUPAC to examine critically its scientific programmes with special attention for the urgency of the projects. Too little attention seems to be focused on timely projects addressing important problems that need quick answers. The structure of the Union should be adapted, in his opinion, to cope with such problems, at the same time maintaining important core activities.

Vice-President Staab's thorough critical assessment roused lively discussions in the divisions, Bureau and Council. Although not everybody was as happy with all of his conclusions, and critical remarks were made especially by the divisions about the timing, the general feeling was that the assessment provided the Union with an inventory of problems to be considered. Although the vice-president's assessment is by definition a personal view, many Council members stressed that Staab's recommendations should all be carefully considered.

Restructuring of the Union

The provisional answer to the wish to restructure the Union was a document on which officers had been working in consultation with divisions, Bureau and the Executive Committee for nearly two years. The document included an addendum prepared in Lisbon. Council accepted this document as workable for the near future, assuming a willingness to implement the intentions.

The main characteristics outlined in the document are the creation of a pool of titular member (TM) positions to undertake special projects and the freedom for divisions to divide their financial means and zero-sum titular members optimally and adapt them to the projects most needed in their fields of specialization, including an outside review process.

The paragraph on the pool reads as follows:

> There shall be a membership pool to be used to undertake projects which fall in one or more of the following categories:
>
> - are of a broad impact on the chemical community or on society at large;
> - are of an urgent character and have an international scope;
> - are within the capabilities of IUPAC and which cannot be tackled by an existing IUPAC commission.
>
> The size of the pool will be equivalent to 24 TMs, which will be available at the General Assembly in Guildford in 1995.
>
> Proposals should be initiated for such projects at a General Assembly. They can come from a division/section or one of its commissions, from the Bureau or from the Council, but proposals coming from outside of the Union will also be considered. The detailed proposals should be available when the Executive Committee meets in April following the General Assembly, in order to prepare them for discussion at the time of the Bureau meeting in September of the same year in a meeting of the officers, the division presidents, and the chairmen of the CHEMRAWN Committee and COCI (Committee on Chemistry and Industry). Proposals should be focused on a specific project (rather than a broad topic or area), with justification for the significance of the project and why it is appropriate for IUPAC. If possible, it should suggest names of possible participants.

A further important decision at the General Assembly was to continue to coordinate the activities of the Union on environmental chemistry. Jack Calvert has been asked to undertake this duty, which will mean in the first place to see whether there is any overlap in these activities and to identify projects which need urgent treatment by IUPAC. A thorough discussion on the role of the Union in environmental chemistry will take place at the Bureau meeting in September 1994.

Letter to the Editor

Advanced materials

Sir,

In the article entitled 'Chemistry of advanced materials' [*Chem. Intl.* **15**, 131, (1993)], Prof. C. N. R. Rao speculated that Lanxide's DIMOX^{TM} directed metal oxidation process is used to make fibres for unknown applications. This is incorrect: we do not, at this time, produce fibres.

In fact, Lanxide and its seven joint venture companies are actively and successfully commercializing ceramic matrix composites and metal matrix composites (fabricated by the PRIMEX^{TM} pressureless metal infiltration process) in the areas of wear products, armour, turbine engine components, aerospace components, heat management components, automotive components, refractories, rocket engine components, electronic components, sporting goods, precision machine components, and many others.

Christopher R. Kennedy
Lanxide Corporation
Delaware, USA

Provisional Recommendations

Classification and definition of analytical methods based on flowing media

This report aims at a classification of analytical methods based on flowing media and the definition (standardization) of terminology.

After the classification and a discussion of terms describing the systems and component parts, a section is devoted to terms describing the performance of flow systems.

The list of terms included is restricted to the most relevant ones. 'Self-explanatory' terms have been excluded. It is emphasized that the usage of terms or expressions that do not adequately describe the processes or procedures involved should be strongly discouraged.

Although belonging to the category of methods based on flowing media, chromatographic methods are not included in the present document. However, care has been taken that the present text is not in conflict with definitions in that domain.

In documents in which flow methods are described, it should be clearly indicated how the sample and/or reagent is introduced and how the sample zone is transported. When introducing new techniques in the field, or variants or existing techniques, it is strongly recommended that descriptive terms rather than fancy names are used.

Comments on the document are welcome and should be sent by 31 May 1994 to: Prof. W. E. van der Linden, Laboratory for Chemical Analysis, Department of Chemical Technology, Twente University of Technology, POB 217, 7500 AE Enschede, Netherlands.

Terminology and notations for multistep electrochemical reaction mechanisms

In this paper, the recommended terminology and the use of symbols are given for a compact description of an electrochemical reaction mechanism, that is, a theoretical sequence of chemical changes occurring at and near an electrode during the passage of electrical current, from a reactant to a particular product.

Recommended nomenclature for multistep electrochemical reaction mechanisms

The symbol **E** represents a single one electron transfer at the electrode.

A chemical reaction occurring near or at the electrode is noted **C**, **C1** for first order, **C1´** for pseudo-first-order reaction, and **C2** for a second-order reaction. Special reactions are often specified by an abbreviation in parentheses, often using the symbolic representation of organic chemists. For example: a protonation is noted **C(AH)**, an electron transfer between two electrochemical couples in solution (solution electron transfer) is noted **T**, a coupling between a reduced (or oxidized) species and the substrate **C2(Ars)**. Successive events are indicated by the sign **+** and concerted ones without any separation.

Some comments about the charge transfer step at the electrode

An electron transfer with simultaneous bond breaking or bond formation is called a *concerted transfer* (noted **ED** or **EA**) and without any chemical bond formation or cleavage is called a *nonconcerted transfer* (noted **E**).

Rate determining step. If it is determined, the rate determining step is noted by a superscript double dagger. (Example $\mathbf{E\ C^{\ddagger}}$).

One example. The recommended nomenclature is shown by a few examples from the literature. One of them is the mechanism of reduction of a carbonyl compound: $\mathbf{C(A_H) + E + C2(Arr)}$.

$$\mathrm{RHC{=}O + H^+ \rightleftarrows (RHC{-}OH)^+} \qquad \mathbf{C(A_H)}$$

$$\mathrm{(RHC{-}OH)^+ + e^- \rightleftarrows (RHC{-}OH)^{\cdot}} \qquad \mathbf{E}$$

$$\mathrm{2(RHC{-}OH)^{\cdot} \rightarrow (RHCOH)_2} \qquad \mathbf{C2(Arr)}$$

Comments on the document are welcome and should be sent by 31 May 1994 to: Dr Claude P. Andrieux, Laboratoire de'Electrochimie Moléculaire, Université Paris 7, 2 place Jussieu, 75251 Paris Cedex 05, France.

Recommendations for the nomenclature of thermometric and enthalpimetric methods in chemical analysis

Calorimetry is one of the oldest measurement techniques in chemistry. A wide variety of types of calorimetry have been developed for a variety of specialized needs. Over the last several decades, enthalpimetric analysis, a subfield of calorimetry, has been developed for analytical purposes. A confusing variety of nomenclature has been used.

This document defines the scope of enthalpimetric analysis within the more general field of calorimetry and distinguishes it form the methods of thermal analysis for solids. Enthalpimetric analysis is limited to those analytical methods in which heat effects are measured for the primary goal of a quantitative determination of a reactant or catalyst, and in which at least one reactant is a liquid or solid. The document provides standardized nomenclature for the basic methods which are in use (that is, direct injection enthalpimetry, thermometric titration, flow injection enthalpimetry, and continuous flow enthalpimetry).

Comments on the document are welcome and should be sent by 31 May 1994 to: Dr. J. W. Stahl, Department of Chemistry, Geneva College, Beaver Falls, PA 150101, USA.

Publications

World Health Organization Publications

WHO Expert Committee on Specifications for Pharmaceutical Preparations

Thirty-second Report

Technical Report Series *No. 823, Published by WHO, 1992, vi + 134 pp. (available in English and French; Spanish in preparation), ISBN 92 4 120823 6. CHF 17.-/USD 15.30; in developing countries CHF 11.90. Order No 1100823.*

This report issues five sets of detailed guidelines intended to assist drug regulatory authorities in implementing a rigorous, comprehensive system for the quality control of pharmaceutical products. Focused on key components in a national system for quality assurance, the guidelines set out up-to-date principles, procedures, standards and requirements that can assist both regulators and manufacturers in their efforts to control the safety, quality, potency, and efficacy of pharmaceutical products.

The first and most extensive set of guidelines presents updated requirements for good manufacturing practices in pharmaceutical production. The requirements, which are presented in three main parts, have been considerably revised and expanded from the 1975 version to reflect advances in pharmaceutical manufacturing technology. Part one outlines the general concepts and essential elements of quality assurance in the production of pharmaceuticals. The second part, on good practices in production and quality control offers guidance on actions to be taken separately by production and by quality control personnel for the implementation of the general principles of quality assurance. The third part sets out supplementary guidelines for the manufacture of sterile preparations and the production of active pharmaceutical ingredients.

The second guidelines provide a step-by-step description of the procedures to be followed during the inspection of pharmaceutical manufacturing facilities in order to ascertain adherence to good manufacturing practices. Details range from advice on the frequency and duration of inspections, through basic rules for conducting an inspection to an outline of the form and content of the inspector's report.

The third guidelines cover implementation of the WHO Certification Scheme on the Quality of Pharmaceutical Products Moving in International Commerce, which has also been revised and considerably strengthened. To make the certification procedures better suited to rigorous control, particularly in view of the increasingly numerous reports of substandard and counterfeit drugs found on the market in developing countries, three different forms of attestation are proposed. These are a product certificate issued by the competent authority in the exporting country; a statement of licensing status, also issued by the competent authority in the exporting country; and a batch certificate, which is usually issued by the manufacturer. Models for each of these forms are also included.

Additional guidelines cover the quality of pharmaceutical and biological products prepared by recombinant DNA technology, and the validation of analytical procedures used in the examination of pharmaceutical products to ensure safety and efficacy at all stages of shelf-life, including storage, distribution and use. The remaining sections provide updated lists of available international chemical reference substances and of adopted international reference substances and of adopted international infrared spectra, and outline a protocol for a study on the quality of selected drugs at the point of use in developing countries.

The report also contains brief, updated information on several other elements of quality assurance. These include, within the development of drug quality assurance, a planned survey on products of questionable stability, priorities for the training of regulators, and arrangements for independent analysis of drug samples.

The Use of Essential Drugs

Model List of Essential Drugs (Seventh List)

Fifth Report of the WHO Expert Committee

Technical Report Series *No. 825, Published by WHO, 1992, iv + 75 pp. (available in English and French; Spanish in preparation), ISBN 92 4 120825 2. CHF 10.-/USD 9.00; in developing countries CHF 7.-. Order No 1100825.*

This book presents and explains the seventh model list of essential drugs issued by WHO as part of its efforts to extend the benefits of modern drugs to the world's population, Intended to guide the selection of drugs in countries where the need is great and the resources are small, the list identifies a core group of prophylactic and therapeutic substances judged capable of meeting the vast majority of health needs and thus deserving priority in purchasing decisions and procurement schemes.

The WHO list identifies a core group of prophylactic and therapeutic substances judged capable of meeting the vast majority of health needs. (*WHO photo by Kenneth E. Mott.*)

The first part of the report provides updated information on several components of national drug policy necessary to assure that essential drugs, corresponding to essential health needs, are available at all times in adequate amounts and in the proper dosage. Apart from advice on the selection of drugs and dosage forms and the procedures required for quality control, the report draws attention to the urgent need for better laboratory monitoring of antimicrobial sensitivity, and to the importance of post-regulation studies to detect adverse drug effects and assess other indicators of drug performance. New sections discuss drug nomenclature, including the problems that arise when trade marks are derived from International Nonproprietary Names, and offer advice on the principles that should be followed when procuring or donating drugs for use in displaced communities, emphasizing the need to align essential drugs with the disease patterns commonly seen in almost every refugee settlement site.

The seventh WHO model list of essential drugs is then presented, together with an explanation of changes made when revising the list. Organized according to therapeutic group, the list includes information on route of administration, dosage forms, and strengths for each of 286 essential drugs. To qualify for inclusions in the list, a drug must be supported by sound and adequate data demonstrating safety, efficacy, and consistent performance in a variety of medical settings, Factors of cost, stability, quality control, and international availability were also considered. Revisions in the list, which were agreed upon by an international group of experts, reflect the availability of new drugs, new information of established drugs, and practical experiences in their use. For the first time, the list includes a selection of essential drugs needed for the palliative care of cancer patients.

A final section presents guiding principles intended to help small national drug regulatory authorities develop a system of legislative and administrative procedures that can assure quality, efficacy and safety, even when resources are limited. The report concludes with a model application form for use when requesting that a drug be included in the list.

International Reporting of Periodic Drug-Safety Update Summaries

Final Report of Working Group II of the Council for International Organizations of Medical Sciences (CIOMS)

CIOMS 1992, 61 pp. (English only), ISBN 92 9036 053 4. CHF 15.-/USD 13.50; in developing countries CHF 10.50. Order No 1840015.

This book presents and explains the standardized format of a proposed single international summary report to be used by drug manufacturers for the periodic updating of safety data on approved pharmaceutical products. Proposals reflect the consensus reached, a following two years of meetings and debate, by a CIOMS Working Group representing 12 pharmaceutical companies and 10 regulatory agencies. The aim of these meetings was to give manufacturing companies a uniform set of procedures for reporting safety information to regulatory bodies. Apart from improving inter-regulatory communications, these uniform procedures should facilitate the work of doctors and scientists responsible for monitoring drug safety in industry.

The need to harmonize safety information of drug products is highlighted in the opening section, which reports the results of a survey of current regulations for periodic safety updates in all countries known to have some safety update reporting requirements. Major differences are noted in the anniversary dates of licensing approval, in the timing of required reports, and in the types and amounts of data required.

The proposals, which cover both the scope and content of a periodic drug-safety update, are presented in the form of a nine-point outline of the core information which should be included in any periodic report. Key points agreed on include the frequency of review and reporting, the need for cumulative information on the drug's licensed status for marketing, and the circumstances under which detailed utilization data should be supplied. Other sections of the book explain how the Working Group reached consensus and describe several issues that will need to be resolved in the future. The book concludes with a 21-page example of a periodic safety update for a fictitious drug product.

Polymer spectroscopy

The June 1993 issue of *Die Makromolekulare Chemie: Macromolecular Symposium* (Vol. 72, 1–213) contains 13 plenary papers presented at the 10th European Symposium on Polymer Spectroscopy. The symposium was held in St. Petersburg, Russia, 29 September – 2 October 1992 and sponsored by IUPAC, Macromolecular Division, in conjunction with the Russian Academy of Sciences: Institute of Macromolecular Compounds, Ioffe Physico-Technical Institute, Institute of Spectroscopy.

ICS Newsletter

The International Centre for Science and High Technology (ICS) in Trieste, Italy, has published the first in a series of newsletters dedicated to informing scientists and institutions about ICS's current programmes and future activities. These newsletters are intended to serve as an information medium for ICS and its associated institutes.

The ICS shares the *raison d'être* and general objectives of the United Nations Industrial Development Organization (UNIDO) which is its Executing Agency. Research is carried out throughout the year in all three of the ICS institutes: Pure and Applied Chemistry (IIC); High Technology and New Materials (IITM); Earth, Environmental and Marine Sciences and Technologies (IIEM).

Contributions on ICS research activities on catalysis at IIC, composite materials at IITM and coastal zone management at IIEM are published in the April 1993 issue of *ICS Newsletter* (Vol. 1, No. 2).

For further information, please contact: ICS Information Unit, International Centre for Science and High Technology, Adriatico Palace Hotel, Via Grignano 9, 34014 Trieste, Italy. Tel.: +(39) (40) 224572. Fax: +39 (40) 224575. Telex: 460449 APH 1.

ISO Standards

The following are some of the new international standards announced by the International Organization for Standardization (ISO) in recent issues of *ISO Bulletin*:

July 1993 issue of *ISO Bulletin*

TC 61	**Plastics**
ISO 9782:1993	Plastics – Reinforced moulding compounds and prepregs – Determination of apparent volatile-matter content
TC 85	**Nuclear energy**
ISO 8299:1993	Determination of isotopic content and concentration of uranium and plutonium in nitric acid solution – Mass spectrometric method
TC 92	**Fire tests on building materials, components and structures**
ISO/ TR 9122-3: 1993	Toxicity testing of fire effluents – Part 3: Methods for the analysis of gases and vapours in fire effluents
TC 138	**Plastics pipes, fittings and valves for the transport of fluids**
ISO 9625: 1993	Mechanical joint fittings for use with polyethylene pressure pipes for irrigation purposes
ISO/ TR 10358: 1993	Plastics pipes and fittings – Combined chemical-resistance classification table
TC 147	**Water quality**
ISO 6107-4: 1993	Water quality – Vocabulary – Part 4
ISO 6107-9: 1993	Water quality – Vocabulary – Part 8
ISO 8466-2: 1993	Water quality – Calibration and evaluation of analytical methods and estimation of performance characteristics – Part 2: Calibration strategy for nonlinear second order calibration functions
ISO 8467: 1993	Water quality – Determination of permanganate index
TC 156	**Corrosion of metals and alloys**
ISO 8044: 1989/ Amd 1: 1993	Amendment 1 tolSO 8044:1989
TC 176	**Quality management and quality assurance**
ISO 9000-2: 1993	Quality management and quality assurance – Part 2: Generic Guidelines for the application of ISO 9001, ISO 9002 and ISO9003
ISO 9000-4: 1993	Quality management and quality assurance – Part 4: Guide to dependability programme management

August 1993 issue of *ISO Bulletin*

TC 17	**Steel**
ISO 10702: 1993	Steel and iron – Determination of nitrogen content – Titimetric method after distillation
TC 20	**Aircraft and space vehicles**
ISO 11075: 1993	Aerospace – Aircraft de-icing/ anti-icing Newtonian fluids, ISO type!
ISO 11076: 1993	Aerospace – Aircraft de icing/ anti – icing methods with fluids
ISO 11077: 1993	Aerospace – Self propelled de-icing/ anti-icing vehicles – Functional requirements
TC 28	**Petroleum products and lubricants**
ISO 26445: 1993	Petroleum products – Determination of ash
ISO 9200: 1993	Crude petroleum and liquid petroleum products – Volumetric metering of viscous hydrocarbons
TC 34	**Agricultural food products**
ISO 2171: 1993	Cereals and milled cereal products – Determination of total ash
ISO 6648: 1993	Rice – Determination of viscoelastic properties at various stages of cooking – Method using a viscoelastograph
ISO 7543-2: 1993	Chillies and chilli oleoresins – Determination of total capsaicinoid content – Part 2: Method using high performance liquid chromatography
ISO 8128-1: 1993	Apple juice, apple juice concentrates and drinks containing apple juice – Determination of patulin content – Part 1: Method using high-performance liquid chromatography
ISO 8128-2:1993	Apple juice, apple juice concentrated and drinks containing apple juice – Determination of patulin content – Part 2: Method using thin-layer chromatography
ISO 10470: 1993	Green coffee – Direct reference chart
ISO 11027: 1993	Pepper and pepper oleoresins – Determination of piperine content – Method using high-performance liquid chromatography
ISO 11050: 1993	Wheat flour and durum wheat semolina – Determination of impurities of animal origin
TC 35	**Paints and varnishes**
ISO 787-10: 1993	General method of test for pigments and extenders – Part 10: Determination of density – Pyknometer method
TC 45	**Rubber and rubber products**
ISO 9924: 1993	Rubber and rubber products – Determination of the composition of vulcanizates and uncured compounds by thermogravimetry – Part 1: Butadiene, ethylene–propylene copolymer and terpolymer, isobutene–isoprene, isoprene and styrene–butadiene rubbers
TC 48	**Laboratory glassware and related apparatus**
ISO 10136-1: 1993	Glass and glassware – Analysis of extract solutions – Part 1: Determination of silicon spectrometry
ISO 10136-2: 1993	Glass and glassware – Analysis of extract solutions – Part 2: Determination of sodium oxide and potassium oxide by flame spectrometric methods
ISO 10136-3: 1993	Glass and glassware – Analysis of extract solutions – Part 3: Determination of calcium oxide and magnesium oxide by flame atomic absorption spectrometry
ISO 10136-4: 1993	Glass and glassware – Analysis of extract solutions – Part 4: Determination of aluminium oxide by molecular absorption spectrometry
ISO 10136-5: 1993	Glass and glassware – Analysis of extract solutions – Part 5: Determination of iron(III) oxide by molecular absorption spectrometry and flame atomic absorption spectrometry
ISO 10136-6: 1993	Glass and glassware – Analysis of extract solutions – Part 6: Determination of boron(III) oxide by molecular absorption spectrometry
TC 58	**Gas cylinders**
ISO 10460: 1993	Welded carbon steel gas cylinders – Periodic inspection and testing
ISO 10461: 1993	Seamless aluminium-alloy gas cylinders – Periodic inspection and testing
ISO 10463: 1993	Cylinders for permanent gasses – Inspection at time of filling
TC 61	**Plastics**
ISO 527-1: 1993	Plastics – Determination of tensile properties – Part 1: General principles
ISO 527-2: 1993	Plastics – Determination of tensile properties – Part 2: Test conditions for moulding and extrusion plastics
ISO 604: 1993	Plastics – Determination of compressive properties
ISO 3167: 1993	Plastics – Multipurpose test specimens
ISO 10364: 1993	Adhesives – Determination of working life (pot life) of multi – component adhesives
ISO 11469: 1993	Plastics – Generic identification and marking of plastic products
TC 77	**Products in fibre reinforced cement**
ISO 390: 1993	Products in fibre-reinforced cement – Sampling and inspection

TC 85	**Nuclear energy**
ISO 8107: 1993	Nuclear power plants – Maintainability – Terminology
ISO 10981: 1993	Determination of uranium in reprocessing plants dissolver solution – Liquid chromatography method
TC 92	**Fire tests on building materials, components and structures**
ISO 5660-1: 1993	Fire tests – Reaction to fire – Part 1: Rate of heat release from building products – (Cone calorimeter method)
ISO 9705: 1993	Fire tests – Full scale room test for surface products
TC 94	**Personal safety – Protective clothing and equipment**
ISO 6942: 1993	Clothing for protection against heat and fire – Evaluation of thermal behaviour of materials and material assemblies when exposed to a source of radiant heat
TC 147	**Water quality**
ISO 6107-3: 1993	Water quality – Vocabulary – Part 3
ISO 9965: 1993	Water quality – Determination of selenium C – Atomic absorption spectrometric method (hydride technique)
TC 175	**Fluorspar**
ISO 9497: 1993	Fluorspar – Experimental methods for evaluation of quality variation
ISO 9498: 1993	Fluorspar – Experimental methods for checking the bias of sampling and sample preparation
TC 176	**Quality management and quality assurance**
ISO 9004-3: 1993	Quality management and quality system elements – Part 3: Guidelines for processed materials
ISO 9004-4: 1993	Quality management and quality system elements – Part 4: Guidelines for quality improvement

Thieme–IUPAC Prize in Synthetic Organic Chemistry

Thieme Publishers and IUPAC, in collaboration with the editors of *Synthesis*, *Synlett* and *Houben-Weyl* have announced the 1994 Thieme–IUPAC Prize in Synthetic Organic Chemistry sponsored by Goerg Thieme Verlag (Stuttgart and New York).

The **Thieme–IUPAC Prize** is presented every two years on the occasion of the IUPAC-sponsored International Conference on Organic Synthesis (ICOS). ICOS-94 will be held in Bangalore, India, on 11–16 December.

The prize of **DEM 10 000** is awarded to a scientist **under 40 years of age** (as of 1 January of the year in which the prize is awarded) whose research has had a major impact on the field of synthetic organic chemistry.

The first Thieme–IUPAC Prize was awarded in 1992 to Stuart L. Schreiber (Harvard, USA) for his outstanding achievements in the application of sophisticated chemical synthesis to crucial problems at the frontiers of molecular biology.

Call for nominations: deadline 15 April 1994

The prize will be awarded on the basis of scientific merit for independent research dealing with synthesis in the broadest context of organic chemistry, including organometallic and organoheteroatom chemistry, photochemistry, medicinal and biological chemistry, natural products, designed molecules, organic polymers and materials.

Proposals must be accompanied by a biographical sketch of the nominee, a list of the candidate's 10 most significant publications, and a statement of how the candidate's research has had a major impact on the field of synthetic organic chemistry.

Nomination materials (8 copies) should be submitted by 15 April 1994 to: The Executive Secretary, IUPAC Secretariat, Bank Court Chambers, 2–3 Pound Way, Templars Square, Cowley, Oxford OX4 3YF, UK. Tel.: +44 (865) 747744. Fax: +44 (865) 747510. Telex: 83147 VIA OR G, attn. IUPAC. Telegrams: IUPAC OXFORD. E-mail: IUPAC@VAX.OXFORD. AC.UK

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Radionuclide pathways

SCOPE report 50 *Radioecology after Chernobyl: Biogeochemical Pathways of Artificial Radionuclides*, published in April 1993, presents the consensus among leading members of the international scientific community on the most significant sources and environmental pathways of man-made radionuclides.

Sir Frederick Warner

RADPATH, the project on biogeochemical pathways of artificial radionuclides, was initiated by the ENUWAR (Environmental Consequences of Nuclear War) Unit at Essex University, UK, and approved and launched by SCOPE (the Scientific Committee on Problems of the Environment of the International Council of Scientific Unions) following its 7th General Assembly in Budapest in June 1988.

Scientists from all over the world have contributed to the conduct of this study through a series of international workshops, supported by a variety of public organisations and private foundations. IUPAC participated actively in the RADPATH project by appointing a panel of experts to review the draft report and help finalize and complete it.

The following text is part of the Foreword and the complete Executive Summary of SCOPE report 50 *Radioecology After Chernobyl: Biogeochemical Pathways of Artificial Radionuclides* edited by Sir Frederick Warner and Roy M. Harrison. It is reprinted here with the kind permission of SCOPE.

Introduction

The explosion of Reactor No. 4 at Chernobyl on 26 April 1986 profoundly affected the world outside. News of the accident was not immediately given but reports of radioactive fallout came quickly from neighbouring countries, and action was taken to prevent contaminated food from being consumed. Some of the emergency measures had serious social and economic consequences which could have been mitigated with better information. This study has brought together the results of an international study on the ways in which radioactive materials released by human activities spread in the environment, but stops short of considering health effects. These are the concern of bodies such as the United Nations Commission on the Effects of Atomic Radiation (UNSCEAR) and the International Commission on Radiological Protection (ICRP), which evaluate the contribution received by humans.

This report is addressed to a wide community of scientists and others who study the environment. The Chernobyl accident had a positive aspect in providing experimental evidence which would not have been available otherwise. The direct scientific interest is important but the project has also been more widely followed. The universal interest in the environment needs to be fed with information if limited resources are to be used economically or difficult choices made. One of these is between burning fossil fuel with the effect on climate or using nuclear power with the possibility of an accidental release of radioactivity. There is also the risk of release from a nuclear weapon. The knowledge presented here should help in assessing what can be done to reduce effects on the environment or humanity.

The study of pathways included is based on radionuclides from the bomb tests, accidents and releases from reprocessing. Contributions are made from other sources, such as fossil fuels, minerals, building materials and soils as well. These are pervasive and have not provided the identification available from individual locations.

The RADPATH study began in Moscow during a workshop in March 1988 to bring up-to-date the forecasts of environmental consequences of nuclear war (ENWAR) made in SCOPE 28, a two-volume report from the Scientific Committee on Problems of the Environment of ICSU (International Council of Scientific Unions). A special session considered the improved models of movement in the atmosphere and their validation by measurements made on Chernobyl fallout. The opportunity was taken to visit the stricken reactor, the abandoned town of Pripyat and the surrounding country and marshes. At the SCOPE General Assembly in Budapest during June 1988, a proposal to begin this study was agreed with a request for the ENWAR Unit at Essex University to carry it out.

A planning meeting later in 1988 at the Royal Society in London appointed a Steering Committee of experts who have organized a series of workshops and preparation of this report. It also identified other sources by which radionuclides are dispersed, such as nuclear weapons tests, accidents as at Windscale, Kyshtym and Three Mile Island and other escapes from the nuclear fuel cycle.

Three principal workshops were held in the UK – University of Essex, 1988 and 1991, and University of Lancaster, 1990. The latter afforded the opportunity to visit the nuclear fuel reprocessing plant at Sellafield. Other meetings with RADPATH participation were held in the USSR (Suzdal 1989, Gomel 1990, Zeleny Mys 1990 and Pushchino 1991), in Luxembourg 1990 through the International Union of Radioecologists and with BIOMOVS, Sweden 1990.

SCOPE launched the RADPATH project at its General Assembly in Budapest.

These meetings provided information from scientists with access to official sources of information as well as from academic and research institutions, but the nongovernmental aspect of SCOPE work has been maintained. The contributions made by the International Union of Radioecologists and the Vernafsky Institute of Geochemistry have been considerable. The individuals who have given their time are identified, with their affiliations, in this report. There are problems in achieving consistency in the units used, especially curies and becquerels, because of old habits. The international collaboration made it impossible to impose uniformity.

EXECUTIVE SUMMARY

The movement of radionuclides in the environment has been studied for many years, with the principal objective of tracing the routes by which they accumulate in the food chain and become available for human consumption. The explosions in Reactor No. 4 of the nuclear power station of Chernobyl in the Ukraine provided a point source for distribution and a unique opportunity to trace the mechanisms by which they are distributed. The quantity and composition of the emissions are capable only of being estimated from environmental measurements, not by direct calculations from the composition of the reactor core and its mode of disintegration. Material deposited around Chernobyl and in neighbouring countries was traced through direct observation of radioactivity and radiochemical analyses through all stages from atmospheric dispersal to deposition and subsequent transfer. A major significance of Chernobyl was the relatively short-lived 'pulse' of emission which it caused. This has proved immensely valuable to the research community as a form of time marker from which the rates of subsequent processes may be estimated.

The basic properties of isotopes of interest and their sources are described in the opening chapter; the coverage is limited mainly to those whose release is due to human activities. A series of case-studies details the incidents which have been important for adding to knowledge of radionuclide behaviour within atmospheric, terrestrial, aquatic and urban compartments of the environment and the pathways through which transfer occurs. Major chapters then give detailed reviews of current knowledge of environmental pathways of radioactivity and recommendations for future research. This is followed by assessments of dosimetry and environmental effects.

Radionuclides that occur naturally in the environment have a pattern of distribution which is in dynamic equilibrium with disturbances due to cultivation, earth movement and weathering. This equilibrium has had superimposed upon it the isotopes, some with comparatively short half-lives, that have arisen from mining, processing and accidents. The local disturbances allow the tracing of pathways through which the radionuclides are dispersed. Those which are most abundant and/or display the greatest activity provide most of the information for this study. These are principally ^{134,137}Cs, ^{90}Sr, ^{103,106}Ru, ^{141,144}Ce ^{29,131}I and ^{238,239,240}Pu. Isotopes of other elements such as ^{110m}Ag, ^{127,129,132}Te, ^{95}Zr, ^{95}Nb, ^{138,140}La, ^{99}Tc and ^{241}Am are included but not treated in great detail.

Sources of environmental radioactivity and isotopes of interest

The artificial creation of radionuclides may result from physical processes involving nuclear fission, nuclear fusion and neutron activation. The most important source of artificially created radionuclides is neutron-induced nuclear fission. The chemical and physical forms of the active species determine deposition, migration and uptake of radioactivity by living organisms.

A variety of systems and processes may introduce radioactivity into the environment. Human activities involving nuclear weapons and the nuclear fuel cycle (including mining, milling, fuel enrichment, fabrication, reactors, spent fuel stores, reprocessing facilities and waste storage) are important, leading to significant creation and releases of radioactivity. Human technology also releases preexisting natural radionuclides which would otherwise remain trapped in the Earth's crust. The burning of fossil fuels (oil and coal) dominates direct atmospheric release of preexisting natural radioactivity.

Since radionuclides are in some respects easier to study than stable nuclides there is an application in their use as environmental tracers. The most important tracers which are of artificial origin are the fission and activation products from nuclear tests. In addition, radioisotopes produced as a result of the bombardment of the Earth's atmosphere by cosmic rays provide useful tracers for studies of stratospheric–tropospheric exchange processes. Radon and thoron, and their associated decay products, are a second group of natural isotopes which may be utilized, for example, in studies of the atmospheric circulation processes of the lower atmosphere.

The physical and chemical form of radionuclides may vary depending on the release and transport condition in addition to the elements' properties. A general distinction can be made between gases, aerosols and particulate material. Particles with high activity concentration, known as 'hot particles', may result from atmospheric nuclear weapons tests or nuclear reactor accidents. This activity is diluted as material is transferred to soil and water directly or via vegetation and movement through other biota.

Some occurrences of significant radioactivity releases to the environment

The presence of radioactivity in the environment may be due to a variety of sources. One such source arises from routine releases which are made, for example, as a result of reprocessing activities undertaken at Sellafield, UK, and Cap de la Hague, France, or due to plutonium production operations at Hanford, USA. Besides planned discharges arising from operations associated with the nuclear fuel cycle, radionuclides may enter the environment as a consequence of accidental releases. Some important nonroutine releases which have occurred include that due to an explosion in a high-level waste storage tank at Kyshtym, former USSR (1957), and those involving nuclear reactors at Windscale, UK (1957); Three Mile Island, USA (1979) and Chernobyl, USSR (1986). Additional releases have occurred upon re-entry of satellites powered by nuclear sources, such as SNAP 9-A (1964) and Cosmos 954 (1978). Whilst the Chernobyl accident is the most serious to have occurred in the history of nuclear reactor operation, other smaller releases are also of importance for the elucidation of potential pathways of radionuclides in the environment.

Radioactivity in the atmospheric environment

The fate of radionuclides in the atmosphere is determined by various physical processes. The degree of dispersion and point of deposition depends on factors such as release parameters, the radionuclide form and meteorological conditions. Deposition of radioactive particles and gases to the ground may occur via dry deposition which includes direct gravitational settling, as well as turbulent transfer, or due to intervention of some form of precipitation (wet deposition). The involvement of precipitation processes may act as a concentration mechanism leading to areas of enhanced deposition. Entrainment of previously deposited material in the atmosphere (resuspension), due to the action of wind, mechanical agitation or falling hydrometers, is another mechanism resulting in the presence of radionuclides with the potential for causing spread of contamination to adjacent clean areas and constituting an inhalation hazard. In some costal areas a proportion of radionuclides discharged into the sea is blown back onto land as seaspray.

Measurements of the concentration of radionuclides in the air and on the ground are complemented by modelling studies, which require appropriate radiological and meteorological input data. A variety of air sampling methods may be used for measuring air concentrations of radionuclides, and a network of air monitoring stations is maintained in many nations. Many sites throughout the world have also been established to monitor the deposition of radionuclides on the Earth's surface. A major problem in most monitoring programmes lies in obtaining samples which are representative of the average deposition over a large area, as this is often highly variable on a small spatial scale. Techniques employed to acquire meteorological data as input to models depend on the release size. Data may be collected via on-site instrumentation or from a standard meteorological observing station, whilst at sea observations may be made either on board ships or gas and oil platforms, or using drifting buoys. Measurement of upper-air conditions are made using balloon-borne radiosondes. Aircraft and weather radar are other sources of valuable information regarding meteorological conditions and, in the case of the latter, to models tracking pollution.

A wide range of atmospheric dispersion and deposition models is available. Detailed modelling studies are an aid in understanding the role and interaction of specific microphysical and meteorological factors, whilst more general models are directly applicable to estimating the environmental consequences of radionuclides released into the at-

Combustion of fossil fuels dominates direct atmospheric release of preexisting natural radioactivity.

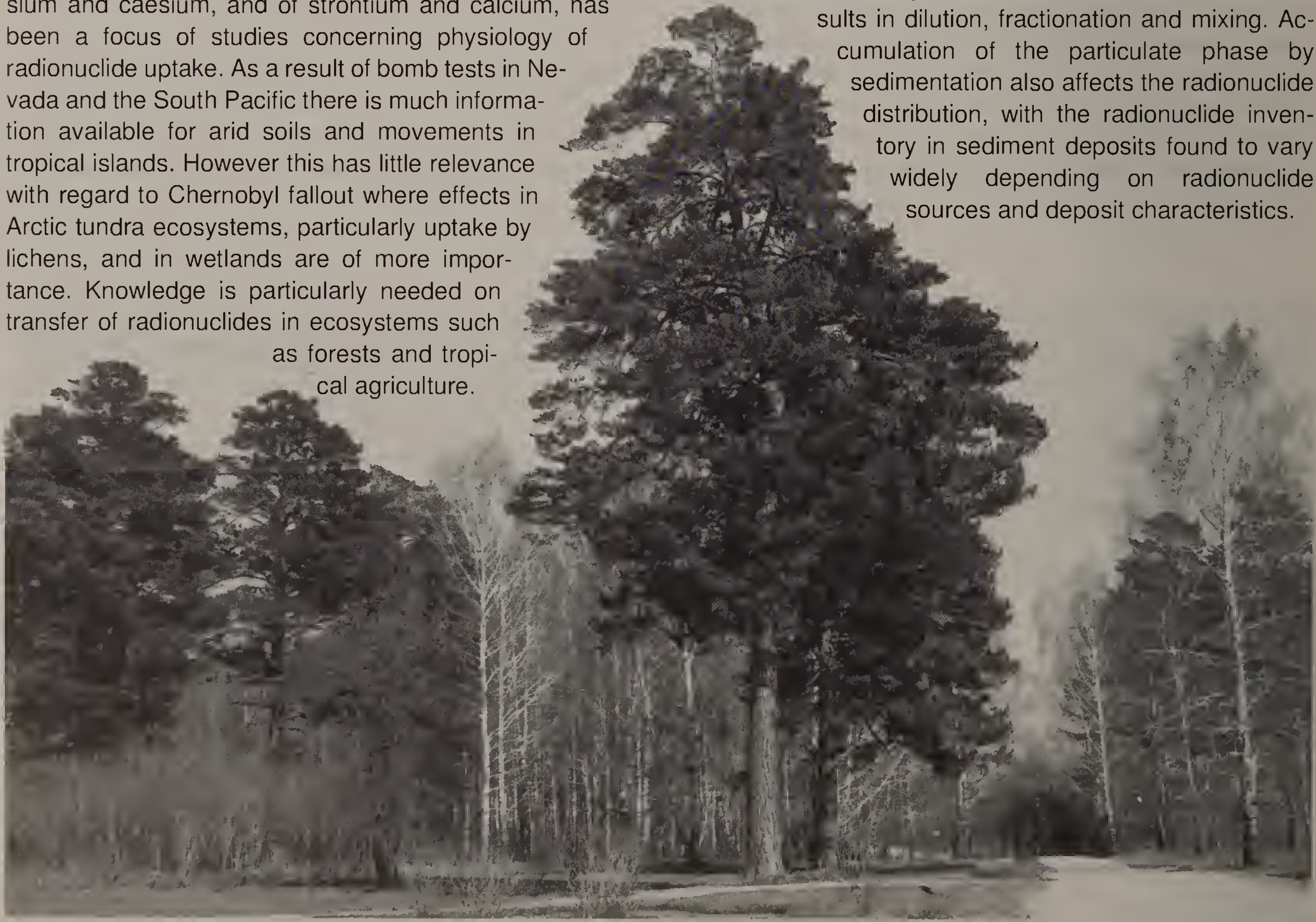
mosphere, which are of particular importance in guiding monitoring teams following accidental releases. The specific purpose for which a model is utilized governs the complexity of the model selected. It is, nevertheless, important that the model simplifications, and limitations induced by the indeterminate nature of the atmosphere, should be recognized. Unique opportunities for model evaluation have been provided by the accidents which occurred at Windscale, Three Mile Island, and Chernobyl, where simulations of atmospheric transport have been compared with radiological observations.

Radioactivity in terrestrial ecosystems

The type of land and vegetation, and deposition mechanism, determine radionuclide behaviour in the environment. The amount of a nuclide intercepted by surface vegetation depends on the surface area of leaves, roughness and botanical composition. Some small transfer of activity also occurs by translocation from the roots. Movement from roots and direct deposits on soil depend on vegetation type, soil geology and water movement. Grazing animals and cultivation cause redistribution in the topmost layer. Soluble materials may be removed from the soil by leaching due to the passage of water. Transfer back to vegetation, and thence to animals, occurs via root systems. A further transfer cycle is associated with mechanisms relating to metabolism, removal in food products, excretion and resuspension due to wind. The chemical similarity of potassium and caesium, and of strontium and calcium, has been a focus of studies concerning physiology of radionuclide uptake. As a result of bomb tests in Nevada and the South Pacific there is much information available for arid soils and movements in tropical islands. However this has little relevance with regard to Chernobyl fallout where effects in Arctic tundra ecosystems, particularly uptake by lichens, and in wetlands are of more importance. Knowledge is particularly needed on transfer of radionuclides in ecosystems such as forests and tropical agriculture.

Radioactivity in the aquatic environment

The pathways of radionuclides in the aquatic environment (which is composed of both aqueous and solid phases and includes rivers, lakes, estuaries, shelf seas, deep oceans, ice sheets, glaciers, groundwater and ground-ice) are of importance since a major fraction of the Earth's surface is occupied by this compartment. The transfer of radionuclides present within the aquatic environment is affected by both nonliving and living components. Radionuclide behaviour in the aquatic environment is determined by transport of the solution and solid phases, the chemical interactions between phases and their biological cycling. Of importance in determining radionuclide behaviour and its solid/solution distribution are the chemical characteristics of the water. An important contrast in the behaviour of radionuclides is observed between aerobic and anaerobic waters, and major differences in ionic composition which exist between saline water and freshwater (and in the latter case between alkaline and acid waters) are of significance in determining radionuclide speciation and behaviour. Furthermore, the solid/solution distribution of radionuclides in the aquatic environment is found to vary with grain size and composition of sediment grains, and bedrock grain surfaces. The nature of the grain surface, particularly the extent to which it is modified by inorganic (oxyhydroxide), or organic deposits, may also be of importance. Moreover, the potential mobility of radionuclide particulate fractions is determined by grain size. Transport of radionuclides within the aquatic environment not only leads to their redistribution, but results in dilution, fractionation and mixing. Accumulation of the particulate phase by sedimentation also affects the radionuclide distribution, with the radionuclide inventory in sediment deposits found to vary widely depending on radionuclide sources and deposit characteristics.



The amount of a nuclide intercepted by surface vegetation depends on the surface areas of leaves, roughness and botanical composition.

Large variability in surface contamination within cities may occur due to wash-off from impervious urban surfaces.

Radioactivity in the urban environment

Since almost three-quarters of the population of the current developed world is located in urban areas, the study of radionuclides in towns and cities is of utmost importance. The distribution pattern of fallout depends on the weather conditions (i.e. wet or dry) and variation in the degree of interception of fallout is found depending on the nature of the surface and the physicochemical form of radionuclides. Large variability in surface contamination within cities may occur due to wash-off from impervious urban surfaces. The nature and rate of removal processes determines the retention behaviour of pollutants. In the outdoor environment wash-off probably governs weathering, whereas within houses cleaning constitutes the major removal process. Predicted dose reductions achievable in the urban environment through the application of various decontamination techniques reveal that digging gardens and defoliating trees should be of highest priority, based upon consideration of cost and effectiveness. Artificial radionuclides have been successfully employed in the study of individual urban environment pathways. Further applications lie in tracer studies of wet deposition, resuspension and wash-off, with applications to pollutant retention behaviour of greatest importance.

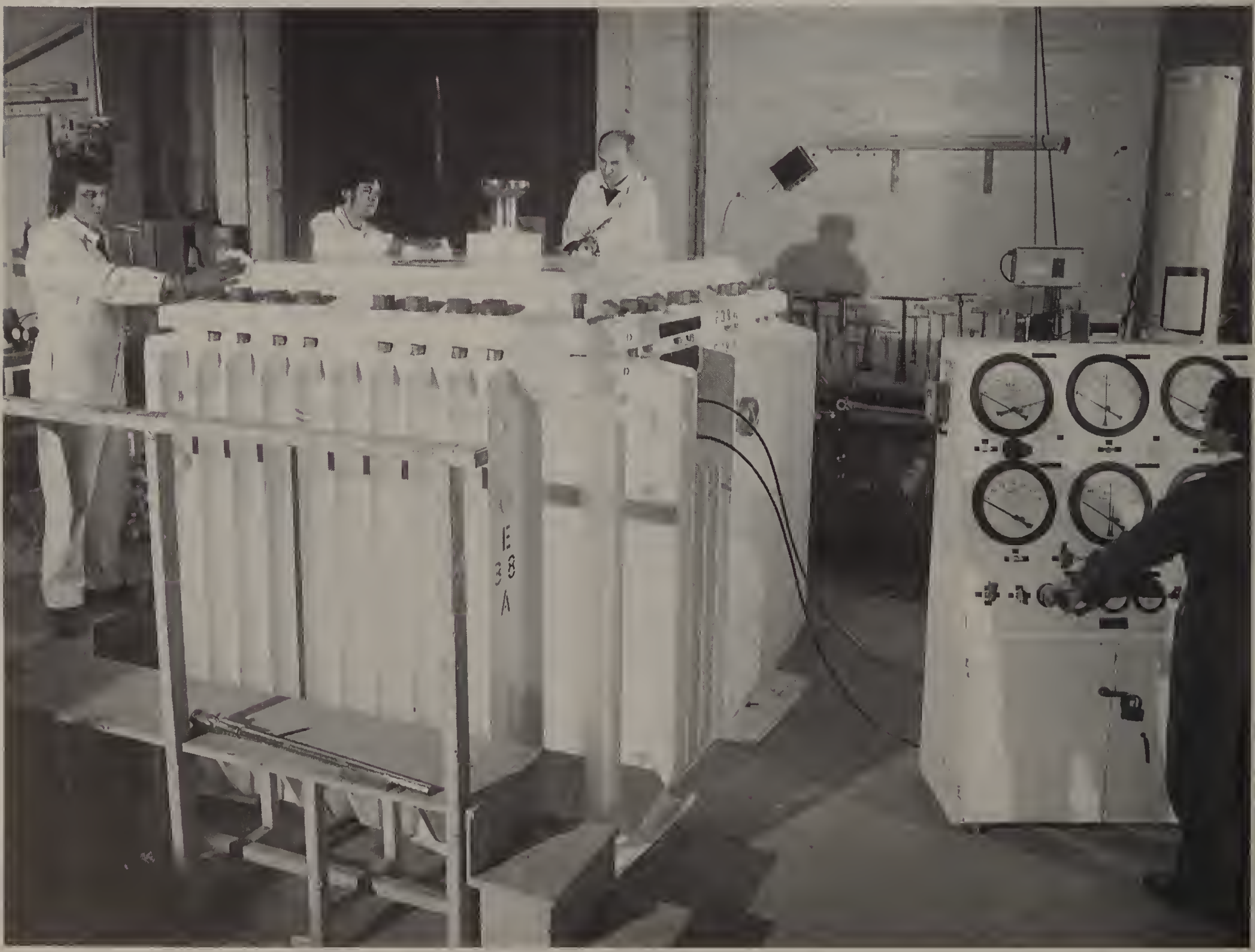
Dosimetry and the assessment of environmental effects of radiation

A consequence of the presence of radionuclides in the environment is the potential for increased radiation exposure of living organisms. The impact of radionuclide releases on organisms may be assessed by consideration of the likelihood and extent of radiation exposure (i.e. radiation dosimetry) and potential consequential effects radionuclides. The Chernobyl accident demonstrated that large (>10 μm) particles could be transported over long distances (>100 km) within the atmosphere and these processes need to be better understood if the development of future accident scenarios is to be reliably predicted. Chernobyl also highlighted the importance of wet processes and orographic effects in deposition of radioactivity. Research is needed into the interaction of radioactive aerosol particles with cloud droplets and into wet deposition generally in convective and frontal systems. The high spatially variable nature of such deposition indicates a need for better understanding of radionuclide atmospheric dispersion in complex terrain and frontal systems, and of 'occult' deposition in cloud and mist. Present understanding of both terrestrial and marine resuspension processes is rudimentary and improved quantitative knowledge is sorely needed.

In the terrestrial environment, knowledge of radionuclide physicochemical speciation is presently poor, particularly in relation to bioavailability to plants and animals. Chernobyl highlighted inadequacies in the knowledge of radionuclide behaviour in organic soils and further research is needed in this area, particularly in relation to long-term processes. Additionally, since much of the deposition in the near-field is in the form of particles, a better understanding is required of their behaviour, both in terms of physical migration of the particles themselves and leaching of the various radionuclides associated. The role of microorganisms in the cycling of radionuclides and of agricultural practices upon radionuclide migration are inadequately understood. Radionuclide behaviour in forests and other natural and seminatural ecosystems is poorly quantified as is the role of secondary sources of radionuclide contamination such as resuspension. Information is generally relatively abundant in relation to major fission products, but is lacking in respect of some 'exotic' species such as ^{110m}Ag. Numerical models of food-chain transfer are steadily improving, but require further validation, especially in regard of transfer parameters. Models for young animals require development and testing.

Research recommendations relating to the aquatic environment highlight the need for studies of freshwater pathways, especially within lakes, due to the sensitivity of the systems to pollution. Collaborative international efforts to study 'hot' zones require improved coordination and intensification. International radioecological studies of polar seas are also recommended. As with the terrestrial environment, the role of microorganisms in biogeochemical cycling is not well understood. The role of the surface microlayer in aquatic systems in influencing radionuclide behaviour is comprehended inadequately and requires further study; improved techniques of sampling the microlayer will be necessary. In freshwater and estuarine systems the importance of interactions of radionuclides with colloids is well documented. Colloidal processes in marine systems however require further study, particularly in relation to size association and speciation of radionuclides.

In the urban environment, the major concern is to understand processes leading to contamination and radionuclide retention and to optimize decontamination. Use of artificial radionuclides will continue to be of value in the study of deposition, (i.e. the radiobiological response). With regard to characteristics influencing the maintenance of population, for the majority of species (other than humans and rare/endangered wild species or valuable domestic animals), it is the population level rather than the individual response to radiation exposure which is considered to be of greatest importance. Nevertheless effects due to increased radiation exposure at, or above, the population level cannot appear without the occurrence of a clear response in individuals which comprise the population. Studies have revealed that no significant effects would be apparent in wild populations of terrestrial animals, provided that the dose rate to the most exposed individuals did not exceed 0.04 mGy h^{-1}, or in terrestrial plants and aquatic plants/animals provided that the dose rates to the most exposed individuals did not exceed 0.4 mGy h^{-1}. With very few exceptions controlled waste disposal operations have not, and would not, cause these values to be exceeded. An exception is the deep ocean disposal of packaged low-level radioactive waste, where high dose rates could potentially be delivered to benthic organisms at the disposal site since the ultimate human exposure, which comprises the present basis for control, occurs far from the dump-site and more than 100 years into the future. In the case of a major nuclear accident such as Chernobyl, although responses have been detected in pine trees, and to a lesser extent in animals, any serious risk to long-term survival of local populations is debatable. However, since nuclear accidents cause global concern, there is need of careful periodic assessment of safety systems and their upgrading to minimize probability of accident occurrence.



Pressure testing and decontamination operations on an Advanced Gas-cooled Reactor (AGR) transport flask for carrying spent fuel, at BNFL Sellafield, in Cumbria, UK. (*PHOTO British Nuclear Fuels Limited.*)

Future tasks and research needs

In summary, the findings contained in this volume constitute an authoritative body of basic scientific information utilizing practical experiences relating to the pathways of radioactivity, which may assist environmental managers and policy makers in achieving a swift and effective response to the assessment of any future (planned or accidental) releases. Wider applications of relevance lie, for example, in advancing knowledge generally of environmental processes and biogeochemical cycling of chemical elements or their compounds. The Chernobyl accident has provided a great impetus to work on this subject by highlighting the need for rapid, reliable predictive capabilities in the event of a nuclear accident. Such predictions of radionuclide behaviour will only be reliable if based upon a solid and comprehensive foundation of research. The tracking of contamination arising from Chernobyl has clearly illustrated areas where present knowledge is partially or even fully inadequate.

Much fundamental and applied research remains to be done. In the atmospheric science field, much is still to be learnt about the physicochemical nature of radionuclides originating from within a hot emission source, and its evolution during atmospheric transport of the various gaseous and particulate forms of airborne radionuclides. The Chernobyl accident demonstrated that large (>10 μm) particles could be transported over large distances (>100 km) within the atmosphere and these processes need to be better understood if the development of future accident scenarios is to be reliably predicted. Chernobyl also highlighted the importance of wet processes and orographic effects in deposition of radioactivity. Research is needed into the interaction of radioactive aerosol particles with cloud droplets and into wet deposition generally in convective and frontal systems. The high spatially variable nature of each deposition indicates a need for better understanding of radionuclide atmospheric dispersion in complex terrain and frontal systems, and of 'occult' deposition in cloud and mist. Present understanding of both terrestrial and marine resuspension processes is rudimentary and improved quantitative knowledge is sorely needed.

In the terrestrial environment, knowledge of radionuclide physicochemical speciation is presently poor, particularly in relation to bioavailability to plants and animals. Chernobyl highlighted inadequacies in the knowledge of radionuclide behaviour in organic soils and further research is needed in this area, particularly in relation to long-term processes. Additionally, since much of the deposition in the near-field is in the form of particles, a better understanding is required of their behaviour, both in terms of physical migration of the particles themselves and leaching of the various radionuclides associated. The role of microorganisms in the cycling of radionuclides and of agricultural practices upon radionuclide migration are inadequately understood. Radionuclide behaviour in forests and other natural and seminatural ecosystems is poorly quantified as is the role of secondary sources of radionuclide contamination such as resuspension. Information is generally relatively abundant in relation to major fission products, but is lacking in respect of some 'exotic' species such as ^{110m}Ag. Numerical models of food-chain transfer are steadily improving, but require further validation, especially in regard of transfer parameters. Models for young animals require development and testing.

The results of field and laboratory research investigations of individual processes need to be translated into compact but effective parametrizations for incorporation within the numerical models.

Research recommendations relating to the aquatic environment highlight the need for studies of freshwater pathways, especially within lakes, due to the sensitivity of the systems to pollution. Collaborative international efforts to study 'hot' zones require improved coordination and intensification. International radioecological studies of polar seas are also recommended. As with the terrestrial environment, the role of the surface microlayer in aquatic systems in influencing radionuclide behaviour is comprehended inadequately and requires further study; improved techniques of sampling the microlayer will be necessary. In freshwater and estuarine systems the importance of interactions of radionuclides with colloids is well documented. Colloidal processes in marine systems however require further study, particularly in relation to size association and speciation of radionuclides.

In the urban environment, the major concern is to understand processes leading to contamination and radionuclide retention and to optimize decontamination. Use of artificial radionuclides will continue to be of value in the study of deposition, retention and clean-up process, leading to the development of improved models.

A consequence of the rapid development of digital computers is that detailed and complex numerical models of multiphase environmental transport, dispersion, deposition and food chain transfer can be constructed. These will of necessity become ever more sophisticated and embrace an ever wider range of biogeochemical pathways. One crucial need is for the results of field and laboratory research investigations of individual processes to be translated into compact but effective parametrizations for incorporation within the numerical models.

SCOPE Report 50: Radioecology after Chernobyl: Biogeochemical Pathways of Artificial Radionuclides *edited by Sir Frederick Warner and Roy M. Harrison was published by John Wiley & Sons, Chichester, UK, 1993. xxxii + 367 pp. ISBN 0 471 93168 3. Price GBP 75.00/USD 120.00.*

News & Views

Changes to atomic weight values

The Commission on Atomic Weights and Isotopic Abundances (II.1), at its meeting at the 37th IUPAC General Assembly in Lisbon, Portugal in August 1993, recommended significant changes to the atomic weight values of four chemical elements. These changes are as follows:

- antimony: 121.757 ± 0.003 to 121.760 ± 0.001
- iridium: 192.22 ± 0.03 to 192.217 ± 0.003
- iron: 55.847 ± 0.003 to 55.845 ± 0.002
- titanium: 47.88 ± 0.03 to 47.867 ± 0.001

The commission has noted with concern the commercial dissemination of significant quantities of laboratory reagents that have been artificially depleted in lithium-6, resulting in labels on containers of reagents with incorrect atomic weight values, which, in fact, may range from 6.94 to 6.99.

The commission has recommended that only International Atomic Energy Agency primary stable isotope standards, such as VSMOW (Vienna Standard Mean Ocean Water), SLAP (Standard Light Antarctic Precipitation), and VPDB (Vienna Peedee belemnite) be used to calibrate laboratory reference materials for use in determining relative stable hydrogen, carbon, and oxygen isotopic abundances.

To eliminate possible confusion in the reporting of isotopic abundances on noncorresponding scales, Commission II.1 recommends that:

1 H-2/H-1 relative ratios of all substances be expressed relative to VSMOW on a scale such that H-2/H-1 of SLAP is 0.572 times that of VSMOW;

2 C-13/C-12 relative ratios of all substances be expressed relative to VPDB on a scale such that C-13/C-12 of NBS 19 carbonate is 1.00195 times that of VPDB;

3 O-18/O-16 ratios of all substances be expressed relative to either VSMOW or VPDB on scales such that O-18/O-16 of SLAP is 0.945 times that of VSMOW;

4 Reporting of isotopic abundances to SMOW and PDB be discontinued.

Tyler B. Coplen

Existing chemicals of environmental relevance

Gesellschaft Deutscher Chemiker (GDCh, the German Chemical Society) has published a new brochure on the work of the German 'Advisory Committee on Existing Chemicals of Environmental Relevance (Beratergremium für umweltrelevante Altstoffe, BUA). The Committee was established by GDCh in 1982 in collaboration with the scientific community, chemical industry and the federal government.

Under the leadership of BUA Chairman, Prof. Ernst Bayer (University of Tübingen), the committee assumed the task of elaborating a scientific basis for tackling environmental problems caused by existing chemicals. To date, chemical, physical, ecological, toxicological and ecotoxicological data of more than 130 chemicals have been collected and evaluated.

A new brochure, *Assessment of existing chemicals: a contribution toward improving the environment* explains the work of BUA and aims to serve as an aid to all those concerned with the impact of chemicals on the environment.

The brochure is available in English or German from the agency of the Gesellschaft Deutscher Chemiker (GDCh), Dr. Heinz Behret, Varrentrappstraße 40–42, 60486 Frankfurt, Germany. Tel.: +49 (69) 79 17 363. Fax: +49 (69) 79 17 322.

Names and Addresses

Full details (names, addresses, telephone/telex/fax numbers, and e-mail) of officers of IUPAC bodies were published in *Chem. Intl.* **15**, 215–227 (1993). The IUPAC Secretariat has since been notified of the following changes:

Prof. Mostafa A. EL-SAYED (Chairman, Monographs for 21st Century, Editorial Advisory Board). E-mail: desal@argon.chem.ucla.edu

Dr Tamas KISS (Chairman, Commission on Equilibrium Data). E-mail: kisstamas@huklte51.bitnet

Prof. Michinori ŌKI (President, Organic Chemistry Division). E-mail: tm01500@jpnousic.bitnet

Prof. Martin QUACK (Secretary, Commission on Physicochemical Symbols, Terminology, and Units). Tel.: +41 (1) 632 4421. Fax: +41 (1) 632 10 21.

Dr Mark SALOMON (Chairman, Commission on Solubility Data). E-mail: msalomon@monmouth-etdl1.army.mil

Prof. Piet STEYN (President, Applied Chemistry Division). Department of Chemistry, Private Bag X6001, University of Potchefstroom for CHE, Potchefstroom 2520, South Africa. Tel.: +27 (148) 99 2020. Fax: +27 (148) 99 2799 (STEYN). E-mail: chemjpf@puknet.puk.ac.za

Dr Dave WESTMORELAND (Chairman, Commission on Microchemical Techniques and Trace Analysis). Tel.: +1 (215) 619 5375. Fax: +1 (215) 619 1607

Prof. George S. WILSON (Chairman, Commission on Electrochemistry). Tel.: +1 (913) 864 5152. Fax: +1 (913) 842 5612/864 5396. E-mail: wilson@kuhub.cc.ukans.edu

Affiliate Affairs

Recycling of polymers: help needed

The IUPAC Working Party on Recycling of Polymers is inviting contributions from scientists and technologists to help with an authoritative report on the current state of knowledge on recycling of polymers (*see* page 36).

Interested persons should contact the chairman of the working party: Dr N. M. Bikales, Division of Materials Research, National Science Foundation, 4201 Wilson Boulevard, Arlington, VA 22220, USA; e-mail: nbikales@nsf.gov.

Information for Affiliates

How to contact commissions

IUPAC affiliates are entitled to communicate directly on scientific matters with the officers of IUPAC commissions. A full list of names and addresses of all commission officers for 1994–95 was published on pages 215–227 of the November 1993 issue of *CI*. Photocopies of this list are available upon request from the Affiliate Affairs Secretary.

IUPAC publications

Affiliates are entitled to a 25% reduction and in some cases a 40% reduction on the cost of IUPAC publications except the scientific journal *Pure and Applied Chemistry*. A leaflet detailing IUPAC books currently available from Blackwell Scientific Publications has recently been distributed by the publishers to all *CI* readers. Further copies may be obtained from the IUPAC Secretariat.

Affiliate reduction of conference registration fees

It is a condition of IUPAC sponsorship of a conference that IUPAC affiliates are entitled to a 10% reduction or 'own members' rate on the registration fee for scientific participants. This concession is usually – but not always – announced in the conference circulars and indicated on the registration form.

To receive this reduction an affiliate must declare on the conference registration form that (s)he is an affiliate. Alternatively the affiliate should apply in writing to the conference organizer for this reduction stating that (s)he is an affiliate. Conference organizers may check with the IUPAC Secretariat that applicants for this reduction are currently registered as affiliates.

If an application for this reduction is refused, an affiliate should immediately notify the Affiliate Affairs Secretary and, if possible, forward copies of documentary evidence of this refusal

Address of IUPAC Secretariat

Please use the following address for all communications directed to the IUPAC Affiliate Affairs Secretary. If you are submitting a letter for publication in *Chemistry International* (*CI*), please indicate that the letter is 'Submitted for publication in *CI*.'

Affiliate Affairs Secretary
IUPAC Secretariat
Bank Court Chambers
2–3 Pound Way
Templars Square
Cowley
Oxford OX4 3YF
UK

Tel.: +44 (865) 747 744
Fax: +44 (865) 747 510
Telex: 83147 VIA OR G
attn. IUPAC
E-mail: IUPAC@VAX.OXFORD.AC.UK

IUPAC-sponsored conferences

If you are interested in attending a conference please apply directly to the conference organizers for the conference circulars and registration forms. An updated list of names and addresses of the organizers of all future IUPAC-sponsored conferences is given in the 'Conference Calendar' published in each issue of *CI*.

Ties and scarves

IUPAC ties and scarves may be purchased from the IUPAC Secretariat by applying to the Affiliate Affairs Secretary. The colours for both are *either* maroon *or* navy (dark) blue. The ties cost USD 14.00/GBP 7.00 each and the scarves USD 12.00/GBP 6.00 (including postage and packing).

Please use the form (or a photocopy of it) published on page 24 of this issue of *CI*. Alternatively please write to the Affiliate Affairs Secretary with your order stating the colour you require. A cheque made payable to IUPAC for the appropriate amount should be enclosed with your order.

IUPAC poster

Copies of an IUPAC poster (see page 214 of the November 1990 issue of *CI*) are available **free of charge** to affiliates and members of IUPAC's commissions and committees. The poster is printed in maroon and black on a white background and is approximately 42 × 59 cm in size.

IUPAC welcomes any publicity you can give to its activities. If you would like to display one or more copies of the poster in your department or elsewhere please write to the Affiliate Affairs Secretary stating your name and address and how many copies of the poster you wish to receive.

Commission & Committee News

CHEMRAWN IX to be held in Seoul

The Lisbon meeting of the CHEMRAWN Committee commenced with a review of further activities from CHEMRAWN VII (Baltimore, USA, December 1991). Dr Pariser outlined two projects aimed at measurement of global warming gases in Third World countries.

Prof. Kuznetsov outlined further actions from CHEMRAWN VIII (Moscow, Russia, September 1992). These include the start of a new journal *Chemistry for sustainable development* as well as a presentation to the Russian Parliament.

It was agreed that the next CHEMRAWN Conference would be held in Seoul, Korea, in 1996. The topic will be 'The Sustainable Use of Materials'.

Subjects for further study included: the chemical treatment of polluted soils; water; and information on environmental matters.

The next committee meeting will be held in Seoul, May 1994.

Alan Hayes

Distance education in environmental chemistry

In view of the enormous growth of interest in distance education in chemistry and the environment, the Committee on Teaching of Chemistry (CTC) decided, at its meeting in Lisbon, to initiate a one-year pilot project in distance education as applied to environmental chemistry. CTC proposes to collaborate with the Commonwealth of Learning (Vancouver, Canada, which coordinates the work of all open universities in the British Commonwealth), and other leading distance education centres.

CTC also proposes to assemble a sample package on teaching of environmental chemistry, based on distance mode techniques. The package is likely to consist of:

- printed material
- suitable experiments and activities
- computer simulations
- audio and video cassettes
- home kit.

An international workshop is planned in 1994 to bring together some leading experts in these areas. The 13th International Conference on Chemical Education (ICCE), which will be held in Puerto Rico, 8–12 August 1994, will feature a CTC organized symposium on distance education.

CTC also considered the extension of relations between education in chemistry and the chemical industry. One CTC member reported on the work done in this field in Brazil and in the UK. This could become the basis of a CTC initiative. As this project develops, CTC proposes to explore possible links with the Committee on Chemical Industry (COCI).

The possibility of holding the next CTC meeting in Puerto Rico before the 13th ICCE is being investigated.

Hans Bouma

Thermodynamics

A large part of the work of the Commission on Thermodynamics (I.2) and its subcommittees deals with thermodynamic and transport properties of pure compounds and mixtures of technological interest, as for instance, new industrial organic solvents and gasoline additives. All of the ongoing projects of the commission and its subcommittees were felt to be progressing well with regular output in the form of books or archival papers. The commission will also become more involved with projects of relevance to biological and biochemical systems.

Proposals for four new projects were submitted in early spring to the division president and have been reviewed by external referees as required by the new procedure adopted by the Division of Physical Chemistry. The four new projects that were approved deal are:

1. Nomenclature of phase diagrams with particular reference to vapour–liquid and liquid–liquid equilibria
2. The theory of equations of state (for a volume in the *Experimental Thermodynamic* series)
3. Set of criteria for the publication of equations of state
4. Vapour–liquid equilibria and related properties in binary and ternary mixtures of ethers with 1-alkanols and n-alkanes.

The effect of the external referee procedure on the work of the commission and the subcommittees was discussed at the Lisbon meeting. The general opinion was that implementation of the procedure, although laudable in theory, makes it impossible in practice to tackle serious problems that need rapid attention. One such project recently emerged from the work of one of the subcommittees of this commission but, for the reason just stated, has had to be addressed as an international cooperative effort outside the aegis of IUPAC. It was felt that this new *modus operandi* means that IUPAC organizations cannot respond in timely fashion to needs in IUPAC-designated hot-spot areas.

The relationship (or lack of it) between the commissions and subcommittees on the one hand and the senior levels of IUPAC on the other came up for discussion a number of times during the meeting. A strong need is felt for a facile means of communication from the commission level upwards in the hierarchy. This problem should be addressed in the discussions of the restructuring of IUPAC.

It is also felt that those in the senior levels may lack a realistic view of the actual work of IUPAC which consists of and depends on projects carried out at the grass roots level by commissions and subcommittees. These projects are carried out through voluntary work and with financial support from outside agencies either directly after grant applications or indirectly by universities and other institutions donating the use of manpower and other resources. It should be realized that IUPAC rarely gives economic support to the project work – although in some exceptional cases, small amounts of seed money are given. A prime duty of the IUPAC leadership should be to facilitate these voluntary, international efforts. In the present situation this commission and its subcommittees feel a lack of this kind of support.

The next meeting of the commission will be held in Clermont-Ferrand, 17 July 1994 in connection with the 13th IUPAC Conference on Chemical Thermodynamics.

Gerd Olofsson

Chemical kinetics

At its meeting in Lisbon in August 1993, the Commission on Chemical Kinetics (I.4) took the following decisions on existing projects:

1. *Computer databases*: This project will be terminated.
2. *Ultrafast reactions*: It was encouraging to note that this project is nearing fruition. A monograph in the Chemistry for the 21st Century Series entitled *Ultrafast reactions* will be submitted for publication to Blackwell Scientific Publications by the end of 1993 and should be published in 1994.
3. *Composite reactions*: This project is now completed and publication is in the hands of the IUPAC administration.
4. *Glossary of terms*: It is with much regret that despite protracted and extensive discussions and considerations it was agreed that this project should be terminated.
5. *Subcommittee on data evaluation for atmospheric chemistry*: The work is still on-going, reflecting the rapidly changing situation in our understanding of atmospheric chemistry. The output from this project is much in demand and is well received by the atmospheric chemistry community.

New projects

Two important and relevant projects in the general area of energy and the environment were enthusiastically approved by the commission. These projects are entitled:

1. 'Evaluated chemical kinetic data for combustion chemistry.'
2. 'Evaluated aqueous solution kinetic data for atmospheric chemistry.'

The latter project is intended to be a joint project with the Commission on Atmospheric Chemistry (VI.4).

Long range plans

Discussions are proceeding with the Subcommittee on Plasma Chemistry (Chairman: J. V. R. Heberlein) on joint projects relating to the chemical kinetics of processes related to environmental clean-up and to high technology materials.

The next meeting of Commission I.4 will be held at the 1995 IUPAC General Assembly in Guildford, UK.

J. A. Kerr

Absorption infrared intensity standards

The Commission on Molecular Structure and Spectroscopy (I.5) continued its deliberations about restructuring itself when it met at the Lisbon General Assembly, 6–8 August 1993. Four exciting projects were adopted at the meeting, namely:

1. *Concepts of molecular structure*: To give greater appreciation of the different average structures obtained from different experimental methods, and also of extremely flexible or weakly bonded molecules, in a book written for graduate students by an international team of experts.
2. *Nonlinear spectroscopy for molecular structure determination*: A manual will be produced by an international team of experts which will explain the various nonlinear spectroscopic techniques for nonspecialists and people working in industry.
3. *Practical standards for nuclear magnetic resonance*: The project will develop methods for obtaining a set of chemical shift references for the complete range of magnetically active nuclei in a coordinated fashion.
4. *Guidelines for the presentation of instrumental parameters in optical and nuclear magnetic resonance Fourier transform spectroscopy*: The purpose is to provide a single page checklist of the experimental conditions that need to be reported to ensure that published spectroscopic experiments can be repeated, in order to assist journal referees, and the maintenance of quality control in industrial and other laboratories.

The commission also completed some of the older projects, the most important of which is the extensive report of the Working Party on Secondary Standards for Intensity Measurements in Infrared Spectroscopy, written by R. Norman Jones and John Bertie. This publication contains various optical parameters for 42 bands of four liquids. To facilitate their use for calibration, a computer program IRYTRUE enables the user to easily determine the path length of any liquid cell with an accuracy of better than 3%.

The next commission meeting will be held at the Guildford General Assembly in August 1995.

Casper Schutte

Commission I.5 has initiated 4 new projects on molecular structure and spectroscopy.

Organic chemistry

The Organic Chemistry Division Committee met at Lisbon from 5–9 August 1993. On the first and final days of this meeting, the chairmen and secretaries of the commissions attended the meeting.

The committee approved the minutes of the meeting at the Hamburg General Assembly in 1991. These were provided by Dr W. J. Koch. The president's report was tabled and discussed. Reports on the editorial advisory board meetings of *Chemistry International* and *Pure and Applied Chemistry* were also submitted and discussed.

The committee considered new Organic Chemistry Division programmes and decided to establish:

- a subcommittee on organic synthesis to be chaired by P. J. Stang with E. Winterfeldt and J. C. Richer acting as liaison officers;
- a subcommittee on bio-organic chemistry to be chaired by Profs Pandit, Norin and Marquet.

At Lisbon, the committee elected Prof. M. Ōki as president of the division, Prof. J. C. Richer as secretary and Prof. G. Scorrano as vice-president. The nominating committee reported that there were eight candidates for three posts as titular members.

The division committee received reports from the chairmen of commissions in the division and reviewed these with the chairmen and also in closed session. The committee also reviewed the list of symposia sponsored by the division and suggestions for official representatives will be forwarded to the IUPAC Secretariat.

At the open meeting, Profs Stang, Winterfeld and Müller were elected as titular members for the 1993–97 term. New proposals of the commissions were also put forward at this meeting. The lists of new members of commissions were reviewed and no problems are expected. Finally the divisional representatives to various committees of the Union were appointed.

Jean Claude Richer

Physical organic chemistry

A major part of the discussions of the Commission on Physical Organic Chemistry (III.2) at its meeting in Lisbon, Portugal, in August 1993, was devoted to the final details of the revision of the 'Glossary of terms in physical organic chemistry'. The glossary has been a labour-intensive undertaking by Paul Müller and a core activity of IUPAC.

Other projects that are in their final stage, are the 'Class names report' and 'Basic terminology of stereochemistry', both of which are joint projects with the Commission on Nomenclature of Organic Chemistry (III.1). The project 'Compilation and critical evaluation of structure–reactivity parameters and equations, Part I, Hammett σ-scale from pK_a measurements of substituted benzoic acids in water', effectively coordinated by John Shorter, will be completed in three years.

The following four new projects successfully passed their feasibility studies and were submitted to the Organic Chemistry Division Committee:

- Guidelines for the publication of research results from empirical force field calculations;
- Glossary of terms used in theoretical organic chemistry;
- Critical compilation of scales of medium effects;
- Compilation and critical evaluation of structure–reactivity parameters and equations, Part II, Hammett σ-scale from pK_a measurements of substituted benzoic acids in aqueous organic solvents.

The next meeting of Commission III.2 will be held in Padua, Italy, probably after the 12th International Conference on Physical Organic Chemistry, 2–4 September 1994.

Wiendelt Drenth

Recycling of polymers

Because the subject of recycling of polymers generates, in so many countries, public discussions that are sometimes based on less-than-reliable information, the IUPAC Macromolecular Division, with the help of ICSU (International Council of Scientific Unions), has decided to establish a working party to deal with this important subject.

The Working Party on Recycling of Polymers held its first meeting on 5–7 August 1993 at the Lisbon General Assembly. Eight of the 10 members from universities, industry and governments of five countries were present.

The working party decided to produce an authoritative report on the current state of knowledge on recycling of polymers; the scientific, technological and economic hurdles that need to be overcome for the successful application of various methods; and possible avenues for future progress. The report will be written for the educated nonspecialist with a first draft ready for discussion at the next meeting. This will be held in the USA from 18–21 July 1994, following the IUPAC-sponsored MacroAkron '94 Symposium. A 2-year target has been set for completion of the report.

A major decision was to publicize this activity so as to attract useful contributions from scientists and technologists willing to help the working party.

Interested persons should contact the chairman of the working party: Dr N. M. Bikales, Division of Materials Research, National Science Foundation, 4201 Wilson Boulevard, Arlington, VA 22220, USA; e-mail: nbikales@nsf.gov

Public discussions on the recycling of polymers are sometimes based on less-than-reliable information.

Functional polymers

The Limited Lifetime Commission (LLTC) on Functional Polymers met at the General Assembly in Lisbon on 7th August 1993. The chairman reported on the new structure of the Commission on Functional Polymers (IV.3). The LLTC ceased to exist with the creation of the new commission.

The current project on the nomenclature of membranes will lead to a publication in 1994. This also holds for the project on 'Polymer liquid crystals' which has now come to an end.

New projects on membranes (standardization of characterization), conducting polymers (polyaniline, standardization of characterization) and biodegradable polymers (mechanisms of degradation) were introduced as feasibility studies.

The next meeting of Commission IV.3 will take place at the Guildford General Assembly in 1995.

J. H. Wendorff

Stability constant database now released

The most important event for the Commission on Equilibrium Data (V.6) during the General Assembly in Lisbon was the official release of the Stability Constant Database, which is a joint venture of IUPAC and Academic Software. SC-Database is the natural successor to, and replacement for, the well-known book compilations of metal-complex stability constants, and now contains nearly 25 000 data from papers published between 1974–89. In addition to a small ceremony in which Allen Bard, President of IUPAC, and other officers of the Union took part, open demonstrations of the computer operation of the database were held almost continuously during the General Assembly for all those interested.

The future work involved in entering all the data from existing books, and from important journals up to the end of 1993 was discussed in detail in the hope of having a revised database for release by 1994–95. We decided that the Subcommittee on Stability Constant Data need not continue to exist and that the work can be taken care of adequately by charging one or two of the titular members of Commission V.6 with the overview of the collection of data in order to keep the database up to date.

The other important task of the commission is the production of critical evaluations of equilibrium data. The critical survey of metal complexes of amino acids is now nearing completion; three parts of this have already been published in *Pure Appl. Chem.* in recent years, one part has been accepted by the Analytical Chemistry Division, and the other two parts are being now reviewed by commission members. The status of other critical surveys including those on hydroxycarboxylic acids, macrocyclic ligands, carbonate, thiocyanate and hydroxide was also discussed. Two new projects to survey complex formation constants of other ligand classes, such as phosphonato- and chloro- complexes were organized and will be submitted for approval to the division. In addition there was a discussion on the necessity of a new way of presentation of results of critical evaluations because of the existence and availability of the SC-Database.

Demonstration of the Stability Constant Database to Commission V.6 members at Lisbon.

A draft report on the specific problems in the measurements and interpretation of equilibrium data in seawater was presented at the meeting and is now being reviewed by commission members. A revised manuscript, if necessary, will be prepared for the even-year-meeting.

The publication of two projects suffered from long delays, one on complex equilibria between metal ions and polyelectrolytes, because of editorial inactivity, and the other on ionic strength correction to stability constants mainly because of technical reasons. The fate of these projects will be decided by the end of 1993. Two other projects on the critical evaluation of equilibria in molten salts and on the use of voltammetric techniques for the determination of stability constants were cancelled as no progress was achieved in either case during the last two years.

One of our existing projects on the critical evaluation of metal complex formation constants of macrocyclic ligands will be contained as a joint project with the Commission on Solubility Data (V.8).

We held joint meetings with the Commission on Electroanalytical Chemistry (V.5) and the Limited Lifetime Commission on Environmental Analytical Chemistry (LLTC), where the status of common projects was discussed.

The next meeting of Commission V.6 will take place in London, UK, at the end of August 1994.

Dennis G. Tuck and Tamas Kiss

Food chemistry

The composition of the Commission on Food Chemistry underwent a major change at the Lisbon General Assembly with the selection of new officers and two new titular members. Discussions at the Lisbon meeting focused on seafood safety, vitamin analysis and food additives of natural origin.

The commission has, it believes, an extremely broad and complex mandate in covering the field of food chemistry. This is reflected in its working group structure, and in the changes in the activities of the working group with time. The Working Group on Immunochemical Methods was dis-

The Commission on Food Chemistry is proposing to hold a workshop on the food safety needs of developing countries.

continued whereas the Working Group on Animal Drugs was strengthened by the decision to invite two new associate members who are experts in the field. Two new working groups were initiated: one on methods of analysis for vitamins in food, and the other on food additives of natural origin. The latter will focus its attention on the natural antioxidant and natural colorants in foods. Finally, increased interest, worldwide, in seafood safety and regulatory programmes being currently developed to ensure seafood safety, has encouraged the commission to increase its efforts in the various aspects of aquatic biotoxins.

At the same time, the commission has active working groups on mycotoxins, aquatic biotoxins, natural toxicants, elemental analysis, halogenated hydrocarbon environmental contaminants, and effects of food processing. These working groups have successfully and collectively completed, with publication, nine projects in the 1992–93 period and currently has 11 active projects.

The Commission also sponsored the highly successful 8th International Symposium on Mycotoxins and Phycotoxins in Mexico City, Mexico, 9–12 November 1992. During the meeting in Lisbon, these working groups proposed nine new projects: three on mycotoxins, including two collaborative studies of methods for aflatoxin and patulin, and one on the 1993 Aflatoxins International Check Sample Program; four focusing on aquatic biotoxins, including two on applications of immunoassays for monitoring seafood for PSP and ciguatoxin, one on an HPLC method for domoic acid in shellfish and one involving unification of nomenclature for aquatic biotoxins; one on the occurrence of pyrolizidine alkaloids in foods; and one on the formation of mutagens in cooked food. In addition, five feasibility studies were proposed including:

1 a proposal to hold the 9th International Symposium on Mycotoxins and Phycotoxins in Rome, Italy in 1996;
2 a proposal to hold a workshop focusing on the food safety needs of developing countries;
3 a proposal to develop a glossary of reference materials used in food analyses;
4 a study of methods for cyanogenic glycosides in cassava;
5 an inventory of currently available methods for PCBs.

The Commission on Food Chemistry has taken the initiative in participating in the activities of organizations outside of IUPAC, including in particular, AOACI, FAO, IDF, and IOCD. These activities, the commissions believes, are essential in view of the worldwide interest in food safety, and in view of its interest in helping developing countries improve their capabilities in food quality and control.

The commission has had an extremely productive two years since the Hamburg General Assembly and had an extremely productive meeting in Lisbon. It looks with excitement to the future.

A. E. Pohland

CD-ROM clinical chemistry project

At its meeting at the IUPAC General Assembly in Boston in 1987, the Commission on Quantities and Units in Clinical Chemistry (VII.2) initiated a project on a database for quantities and units in clinical laboratory sciences. The project will combine, in electronic form on a CD-ROM disk, the projects on the 'Glossary of terms on quantities and units in clinical chemistry' and the 'Compendium of nomenclature and terminology in clinical laboratory sciences'. The disk will allow ease of access of the data. The glossary and the compendium will also be published in hard copy in paper or book form.

Standard text software together with a related database facility will be used for the combined project. The project will include, in due course, each medical speciality, the syntax following IUPAC recommendations, and the semantics determined by the international organization representing each medical speciality.

The next meeting of Commission VII.2 will be held in Lillehammer, Norway.

Conference Calendar

Conference circulars and registrations forms for the IUPAC-sponsored conferences listed below may be obtained, upon request, from the names and addresses shown in italics.

1994

Natural products chemistry

16–20 January
19th International Symposium on Natural Products Chemistry.
Karachi, Pakistan.
Prof. Atta-ur-Rahman, Chairman, Organizing Committee, H.E.J. Research Institute of Chemistry, University of Karachi, Karachi-75270, Pakistan.
Tel.: +92 (21) 470007 or 476131.
Fax: +92 (21) 4963373 or 4963124.
E-mail: atta%hejfirst@unet.uu.net.

High temperature materials chemistry

4–9 April
8th High Temperature Materials Conference (HTMC VIII).
Vienna, Austria.
HTMC VIII, Gesellschaft Osterreichischer Chemiker, Nibelungengasse 11/6, A-1010 Wien, Austria.

Pesticide chemistry

4–9 July
8th International Congress of Pesticide Chemistry.
Washington, DC, USA.
Dr J. R. Plimmer, ABC Laboratories, 7200 ABC Lane, PO Box 1097, Columbia, MO 65205, USA.

Macromolecules

11–15 July
35th International Symposium on Macromolecules. Ohio, USA.
Macroakron'94, Cathy Manus-Gray, Symposium Coordinator, Institute of Polymer Science, The University of Akron, Akron, OH 44325-3909, USA.
Tel.: +1 (216) 9725334. Fax: +1 (216) 9725463. E-mail: Manusgray@UAkron.

Chemical thermodynamics

17–22 July
13th International Conference on Chemical Thermodynamics.
Clermont-Ferrand, France.
Prof. J.-P. E. Grolier, Laboratoire de Thermodynamique et Génie Chimique, Université Blaise Pascal, Clermont-Ferrand, 63177 Aubière, France.

Carbohydrates

17–22 July
17th International Carbohydrate Symposium.
Ottawa, Canada.
Dr H. Jennings, Institute of Biological Sciences, National Research Council of Canada, 100 Sussex Drive, Ottawa, Ontario, Canada, K1A OR6.

Visas

It is a condition of sponsorship that organizers of meetings under the auspices of IUPAC, in considering the locations of such meetings, should take all possible steps to ensure the freedom of all bona fide chemists from throughout the world to attend irrespective of race, religion, or political philosophy.

IUPAC sponsorship implies that entry visas will be granted to all bona fide chemists provided application is made not less than three months in advance. If a visa is not granted one month before the meeting the IUPAC Secretariat should be notified without delay by the applicant.

Photochemistry

17–22 July
15th IUPAC Symposium on Photochemistry.
Prague, Czech Republic.
Prof. J. Michl, Department of Chemistry & Biochemistry, University of Colorado at Boulder, Boulder, CO 80309-0215, USA.

Excitonic processes in condensed matters

19–22 July
International Conference on Excitonic Processes in Condensed Matters.
Darwin, Australia.
Dr J. Singh, EXCON 94, Faculty of Science, Northern Territory University, P.O. Box 40146, Casuarina, NT 0811, Australia. Tel.: +61 (89) 466811. Fax: +61 (89) 410460. E-mail singhjai@darwin.ntu.edu.au.

Coordination chemistry

24–29 July
30th International Conference on Coordination Chemistry.
Kyoto, Japan.
Prof. H. Ohtaki, Laboratories of Coordination Chemistry, Institute for Molecular Science, Myodaiji-cho, Okazaki 444, Japan.

Polymer networks 94

25–29 July
35th Microsymposium on Macromolecules.
Prague, Czech Republic.
35th Microsymposium, P.M.M. Secretariat, c/o Institute of Macromolecular Chemistry, Academy of Sciences of the Czech Republic, 162 06 Prague 6, Czech Republic.

The 13th International Conference on Chemical Education will be held in Puerto Rico.

Chemical education

8–12 August
13th International Conference on Chemical Education. Chemistry: The Key to the Future. Puerto Rico
Dr Ram S. Lamba, Metropolitan Campus, Inter American University of Puerto Rico, PO Box 191293, San Juan, PR 00919-1293, Puerto Rico.

Raman spectroscopy

22–26 August
14th International Conference on Raman Spectroscopy. Hong Kong.
Prof. Nai-Teng Yu, Department of Chemistry, The Hong Kong University of Science & Technology, Clear Water Bay, Kowloon, Hong Kong.

Solubility phenomena

22–26 August
6th International Symposium on Solubility Phenomena. Buenos Aires, Argentina.
Dr Angela F. Danil de Namor, Department of Chemistry, University of Surrey, Guildford, Surrey, UK. Tel.: +44 (483) 300800, ext. 2588. Fax: +44 (483) 300803.

Macrocyclic ligands

29 August – 1 September
2nd International Symposium on Macrocyclic Ligands for the Design of New Materials. Buenos Aires, Argentina.
Dr Angela F. Danil de Namor, Department of Chemistry, University of Surrey, Guildford, Surrey GU2 5XH. Tel.: +44 (483) 300800, ext. 2588. Fax: +44 (483) 300803.

Physical organic chemistry

September
12th International Conference on Physical Organic Chemistry. Padova, Italy.
Prof. G. Scorrano, Dipartimento di Chimica Organica, Università degli Studi di Padova, Via Marzolo 1, 35100 Padova, Italy. Fax: +39 (49) 831222.

Liquid crystal polymers

6–9 September
International Conference on Liquid Crystal Polymers. Beijing, China.
Prof. Xibai Qiu, Chinese Chemical Society, PO Box 2709, Beijing 100080, China.

Thermal analysis and calorimetry

11–16 September
6th European Symposium on Thermal Analysis and Calorimetry (ESTAC). Grado, Italy.
Prof. A. Cesàro, Dipartimento di Biochimica, Biofisica E, Chimica Delle Macromolecole, Via Valerio 22, I-34127 Trieste, Italy.

Medicinal chemistry

19–23 September
13th International Symposium on Medicinal Chemistry. Paris, France.
Prof. O. Lafont, Laboratoire de Pharmacochimie, Faculté de Médecine et de Pharmacie de Rouen, BP 97, 76803 St. Etienne-du-Rouvray Cédex, France.

Organic synthesis

11–16 December
10th International Conference on Organic Synthesis. Bangalore, India.
Prof. G. S. R. Subba Rao, (Secretary, ICOS-10), Department of Organic Chemistry, Indian Institute of Science, Bangalore 560 012, India.

1995

Toxicology and clinical chemistry of metals

10–13 July
5th COMTOX Symposium on Toxicology and Clinical Chemistry of Metals. Vancouver, BC, Canada
Prof. F. W. Sunderman, Jr., Departments of Laboratory Medicine and Pharmacology, University of Connecticut Medical School, Post Office Box 1292, Farmington, Connecticut 06034-1292, USA. Tel.: +1 (203) 792328. Fax: +1 (203) 6792154.

How to apply for IUPAC sponsorship

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International Union of Pure and Applied Chemistry (IUPAC)

IUPAC

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The International Union of Pure and Applied Chemistry (IUPAC), formed in 1919, is a voluntary non-governmental, non-profit association of organizations, each of which represents the chemists of a member country. Its objectives are:

- to promote continuing co-operation among the chemists of the member countries;
- to study topics of international importance to pure and applied chemistry which need regulation, standardization, or codification;
- to co-operate with other international organizations which deal with topics of a chemical nature;
- to contribute to the advancement of pure and applied chemistry in all its aspects.

The membership of IUPAC presently comprises 42 countries, each represented by a national organization, such as an academy of science or research council.

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Chemistry International

IUPAC

1994, Vol. 16, No. 1 (January)

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0193-6484(199401)16:1;1-5

Printed in England by Honey Press Ltd. (Banbury)

ISSN 0193-6484

Chemistry International

The news magazine of the International Union of Pure and Applied Chemistry (IUPAC)

2nd IUPAC WORKSHOP
ON
SAFETY IN CHEMICAL PRODUCTION

IUPAC

1994, Vol. 16. No. 2 (March)

Blackwell Scientific Publications

Chemistry International

The news magazine of the International Union of Pure and Applied Chemistry (IUPAC)

EDITOR: Michael Freemantle
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PRODUCTION EDITOR: Martin Clutterbuck

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Six issues of *Chemistry International* will be published bimonthly in 1994. The 1994 subscription rate including postage is GBP 58.00 (UK and overseas except North America) or USD 91.00 (US and Canada). The individual subscription rate is GBP 27.50 (UK and overseas except North America) or USD 39.50 (US and Canada). Microfiche subscriptions are available simultaneously with the printed edition, and microfilm at the end of the subscription year. Subscription orders may be placed directly with IUPAC's official publisher, Blackwell Scientific Publications Ltd, PO Box 88, Oxford, UK.

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Despatch. The news magazine is despatched within Europe by surface mail, to other continents by various forms of air-speeded delivery: to the US* by air freight for forwarding by second-class post, to India by air freight for guaranteeed local delivery, and to all other countries by Accelerated Surface Post.

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*Second-class postage paid at Rahway, NJ. Post Master, send address changes to *Chemistry International*, c/o Mercury Airfreight International Inc., 2223 Randolf Avenue, Avenel, NJ 07001, USA.

Front cover: Ammonia plant, Ludwigshafen, Germany (*Photo: BASF*).

International Union of Pure and Applied Chemistry

Safety in chemical production

Kazuo Saito

The 2nd IUPAC Workshop on Safety in Chemical Production was held in Yokohama, Japan, on 31 May – 4 June 1993. The programme covered safety management, education and training, evaluation of hazards, and engineering, and included cases studies involving visits to local industries.

Prof. Kazuo Saito (International Christian University, Mitaka, Tokyo, Japan) was President of the IUPAC Inorganic Chemistry Division (1985–87).

Introduction

The 2nd Workshop on Safety in Chemical Production took place at Pacifico Yokohama, Kanagawa Prefecture, Japan, on 1–4 June 1993. Kenzi Tamaru, Chairman of the Japanese National Committee for Chemistry, was the Chairman and Kenkichi Nukada, a member of the IUPAC Committee on Chemistry and Industry (COCI) was general secretary of the organizing committee.

Over 523 participants from 30 countries attended the workshop. These included 60 representatives from Third World countries, 11 of whom were sponsored by the United Nations Industrial Development Organization (UNIDO) in Vienna, Austria. Japanese participation totalled 436 including 328 from industry, 63 from local government organizations and 45 from academia.

The first and second days of the programme were based on four main sessions of invited lectures. The third day was devoted to visits by about 300 of the participants to various factories and research institutes in the vicinity. Ten parallel panel and group discussions were held on the final day. This led to a session entitled 'Overview and recommendations' which followed the closing ceremony.

Safety management

Session I consisted of six invited lectures on safety management in chemical plants and universities in various parts of the world. In particular, the role of government was discussed.

Dr H. Künzi (Hoffmann-La Roche, Switzerland) summarized 'Safety management at chemical plants in Europe'. He considered the concept of risk management and organizational measures and referred to the important capital 'C's: company culture; command/control; communication; commitment and cooperation.

Mr D. G. Wika (Du Pont, Singapore) spoke about 'Achieving excellence in process safety management'. He defined process safety management as the application of systems and controls (programme, procedures, audits and evaluations) to a manufacturing or chemical process in a way that process hazards are identified, understood and controlled. He advocated four effective key steps:

- Establishing the safety culture;
- Management, leadership and commitment;
- Implementation of a comprehensive process safety management programme;
- Achieving operating excellence.

Mr I. Hori (Kanagawa Prefectural Government) discussed 'The role of government for safety management in Japan'. He introduced a unique system in Japan for the development of industries under the general orientation, assistance and regulation of local and national governments. The regulations were accepted as a national minimum standard since they aim to protect both the community and the environment from pollution, from work area hazards such as explosions or fire and from the problems related to waste disposal. Hori summarized the objectives and features of four major laws for safety enhancement, and discussed the assignment of roles to local and national governments. He also mentioned a new policy for enhancing the processors' own responsibility in safety management and new methodologies in risk management related to occupational safety assessment and risk assessment of earthquakes.

Pacifico Yokohama.

Mr Y. Sakami (Sumitomo Chemical Co) introduced the topic 'Safety management at chemical plants in Japan'. Since the 1970s the chemical industry in Japan has made strenuous efforts under the slogan 'There should be no production without safety'. Sakami stressed the synergetic endeavours of local and national governments, the academic role played by academics and the practical role of industry.

Prof. K. Tamaru (Science University of Tokyo) explained the involvement of the National Committee for Chemistry, Science Council of Japan (the IUPAC National Adhering Organization in Japan) in improving safety in universities. He referred to a report of industrial safety and environmental specialists who inspected 38 university chemistry laboratories. The report expressed serious anxiety about the hazards of overcrowded laboratories and indicated measures that needed to be taken urgently to eliminate these hazards.

Education and training

The second session was devoted to education and training. Discussions covered universities, chemical plants and the formation of a global network. Two of the nine invited lectures concerned the present state of education in universities in Europe (S. J. Cox, Loughborough University of Technology, UK) and Mexico (J. Garfias, Institute Nationale de Ecologia).

Other lectures were devoted to safety education and training in chemical plants in Europe (D. G. Mooney, Shell, Netherlands), Japan (Y. Funakoshi, Asahi Chemical Industry), Korea (Y. S. Lee, National Polytechnic University), and USA (S. Schreiber, American Institute of Chemical Engineering). Special emphasis was placed on continuing professional development. Funakoshi emphasized the importance of the following three steps in education and training to create good habits and naturally correct behaviour: (1) acquiring correct knowledge; (2) training for suitable actions, and (3) creating good habits through repetition.

Mr A. M. Al-Nekhilan (Eastern Petrochemical Co.) spoke about 'Safety and petrochemical plants in Saudi Arabia: industrial strategy, manpower development and case study'. He stressed the role of three organizations: Royal Commission for Jubail and Yanbu (an industrial city), Saudi Basic Industries Corporation, and Eastern Petrochemical Co. These organizations endeavoured to establish not only a fundamental strategy for developing modern chemical industry and infrastructure, but also strict rules and guidelines for safety and environmental protection.

Workshop discussion session.

Dr B. Sugavanam (UNIDO) proposed the establishment of a Global Network for Safety in Chemical Production (GLONESA). As most developing countries lack the necessary mechanism and trained personnel to enforce safety rules and regulations in the work place, UNIDO is actively involved in facilitating safety at national and regional levels.

The session continued with a demonstration of the following experiments useful for training recruits organized by A. Sawa (Toray Ind): Flash-point and combustion phenomena; Explosion limits of flammable gas; Prevention of flame propagation at the flame arrester; Explosive limits dust; Secondary explosion induced by a dust explosion; Electrification due to liquid flow, friction, the body and a jet stream; Ignition by non-intrinsically safe electrical circuit.

Evaluation of hazards

Session III concerned the evaluation and identification of hazards and included lectures on reactive chemicals (F. Stoessel, Ciba-Geigy AG, Switzerland), new chemicals (T. Hirota, Mitsubishi Kasei Corp, Japan) and chemical processes (E. W. Callahan, Allied Signal Inc., USA).

Stoessel stressed that careful examination of heat balance shows how a reaction can change from its normal course to a runaway pathway. This can result in loss of control. Runaway reactions are always the consequence of lack of sufficient heat removal. A powerful tool is the development of the runaway scenario. This helps to measure the data actually required for the risk assessment.

Hirota emphasized the important role of chemical industry research institutes. They are advised to examine compliance with safety regulations at each stage of research and development.

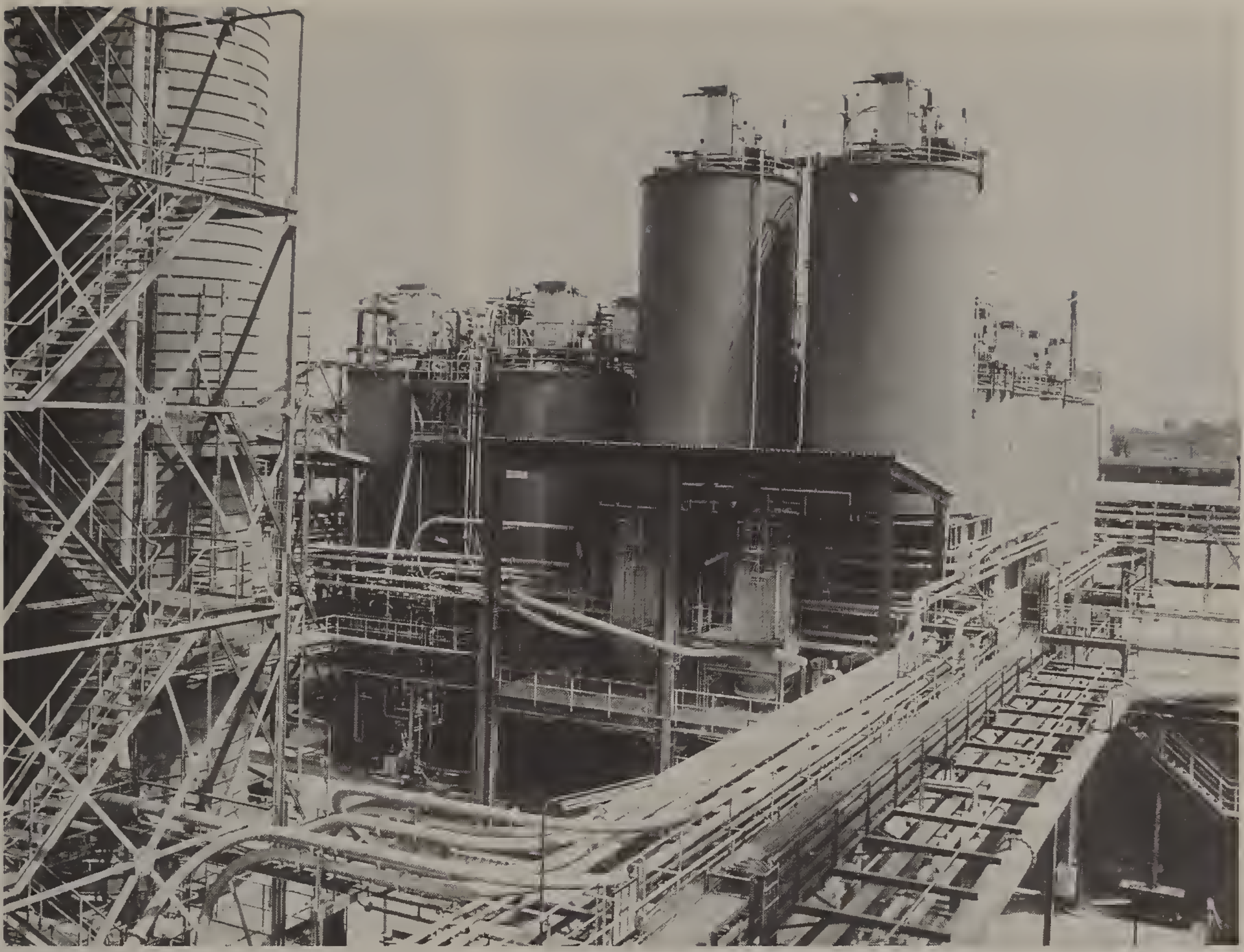
Callahan pointed out that acute hazards, which are the primary focus of hazard analysis activities in US chemical industry, are differentiated from chronic hazards which are also subject to US law. He presented qualitative methodologies including hazard and operability studies (HAZOP) available for hazard evaluation.

Ms S. C. Wills (Chemical Manufacturers Association [CMA], USA) lectured on 'The development and status of the American National Standard for the Preparation of Material Safety Data Sheets (MSDS)'. Since chemical manufacturers are responsible for writing MSDS for all hazardous substances covered under Hazard Communication Standard (HAZCOM), CMA, a trade association representing manufacturers of about 90% of the productive capacity, has set sail to investigate and act on the issue. The CMA work group began with the organization of information on an MSDS which can answer the following basic questions:

1 What is the material and what do I need to know immediately in an emergency?
2 What should I do if a hazardous situation occurs?
3 How can I prevent hazardous situations from occurring?
4 Is there any other useful information about this material?

CMA is soliciting comments from chemical manufacturers in the USA.

Dr V. Pilz (Bayer AG, Germany) talked about the 'Identification of hazards' and suggested that it should be based on knowledge of the properties of materials, process characteristics, process parameters and plant design parameters.



Workshop session IV considered technical problems related to risk reduction, factory automation and inspection standards in various sectors of the chemical industry.

Hazards are identified by comparison of process data and possible deviations from these data with danger areas determined by experiment. Hazard identification must be integrated into every stage of the development and design of a process from the laboratory bench scale to detailed engineering. Pilz also discussed various problems specific to each stage and noted that each process design and each stage can bring new hazards that need to be carefully investigated.

Engineering

Session IV on engineering was unique. Technical problems related to risk reduction, system control including fuzzy control, factory automation, and inspection standards including on-stream inspection were discussed on the basis of accumulated studies and experiences in various sectors of the chemical industry.

Dr H. Sawa (Dow Chemical Pacific Ltd., Japan) emphasized, in his talk on 'Risk reduction in a chemical plant', the importance of inherently safer plant design practices, including improved plant layout, inventory reduction, safer equipment selection, safer structural design of the process and tank yards, safer instruments and control systems. He also stressed the importance of better management systems, for example, with respect to reviewing the chemistry and the process, the emergency response system, and the safer transportation of hazardous materials.

Mr C. M. Pietersen (Institute of Environmental and Energy Technology, Netherlands) discussed, in his lecture on 'Risk analysis and knowledge-based expert systems', the development of a wide range of software tools which assist hazard identification, reliability and consequence analysis, quantified risk analysis and real-time operator decision support. On the basis of more than 10 years' experience in safety and risk analysis, Pietersen gave an overview on the different application domains and the availability and state of the art of software systems with special reference to decision support and expert systems.

Dr S. Yamamoto (Yokogawa Electric Corp., Japan) spoke about 'The fuzzy control system for chemical plants'. This system was applied to a cellulose decomposition batch reactor, paper machine bone-dry profile control and set-point of an electric furnace temperature control. At present however, reliable mathematical models in some processes are obtained with difficulty. In such cases it is desirable to automate the process imitating experienced operator manipulations.

Dr M. Polke (RWTH Aachen, Germany) discussed 'Process automation in the chemical industry' with reference to the use of suitable models based on architectural principles for information techniques used to describe mass, energy and information flows. The principles include that of abstraction (used in object orientation) and transformation which enables the description of all kinds of processes.

Mr T. J. Britton (Health and Safety Executive, UK), in his paper on 'Inspection standards for chemical plants' outlined the activities of the executive. He described the key elements of successful health and safety management, the key points to be inspected and the techniques used in the UK for inspection of chemical plants. Mr J. Pearson from the same organization spoke about 'The safety assessment of on-line computer systems' and described the UK experience in operation of computer based systems for control and protection in both onshore and offshore oil and gas exploration installations, citing the lessons learnt from accidents. Mr W. L. Hatler (Exxon Chemical Co. USA) delivered a lecture on 'Inspection standards for chemical plants in the USA'.

Workshop speakers (from left): Dr J. Garfias, Dr Y. S. Lee, Mr A. M. Al-Nekhilan and Ms S. C. Wills.

Visits to factories and research institutes

The third day of the workshop was devoted to visits to 13 factories and research institutes. These provided case studies on the following topics:

1. Risk evaluation (Nippon Petrochemicals Co. Ltd.)
2. Maintenance and inspection systems (Tonen Chem. Corp.)
3. Practice and danger prediction and hazard prediction for process operation (Showa Denko Co. Ltd)
4. Safety education (Asaha Chemical Industry Co. Ltd.)
5. Antiseismic counter measurement (Tokyo Gas Co. Ltd.)
6. Experiment of facility against earthquake (Ishikawajima-Harima Heavy Industries Co. Ltd.)
7. Food production and safety (Ajinomoto Co. Inc.)
8. Safety and semiconductor gases (Toyo Sanso Co. Ltd.)
9. Safety management in the bioindustry (Kirin Brewery Co. Ltd.)
10. Safety for R & D (Mitsubishi Kasei Corp.)
11. Safety management at an automobile plant (Nissan Motors Co.)
12. Safety management at a steel plant (Nippon Kokan Corp.)
13. Experiment of tank fire and measurement of upper flash point (Fire Research Institute, Fire Defence Agency).

Group and panel discussions and final session

On the final day, 10 parallel sessions were held to discuss the following topics of common interest: Hazard evaluation and chemical education; Thermal analysis; Biosafety; Dust explosions; Electrostatic hazards; Modification of safety operation manuals; Safety education in universities; Safety education in industry; Education and training centre activities; Future work of IUPAC and COCI.

In each of these sessions, each panellist presented a keynote lecture. This was followed by discussion.

In the session on education and training centres, J. A. Kopytowski (UNIDO) analysed the structure of chemical industry in developing countries and compared the production efficiency, rules and regulations and risk of accidents between developed and developing countries. He suggested managerial action can be taken even with limited financial resources. Such action can relate to education and training, dissemination of safety information on hazardous materials, transfer of inherently safe technology and know-how in safety management and contingency planning, and advice to government with regard to adequate regulations. Sugavanam (UNIDO) proposed the establishment of an education and training centre as part of GLONESA (see above). This could act as an international cooperation centre for the dissemination of information, training of safety management experts, and advice to government. The formation of national focal points and regional associations under the umbrella of GLONESA was suggested. The importance of UNIDO as the mediator between developed countries (represented by IUPAC) and developing countries was emphasized.

In the session on the future activities of IUPAC and COCI there was much discussion on their role in promoting safety in chemical production – especially in developing countries. Callahan put forward a tentative plan for the 3rd IUPAC–COCI Workshop on Safety in Chemical Production, which is scheduled to take place in New York, USA in 1995. He emphasized the importance of the creation of a partnership between the three economic poles of Europe, Japan and the USA, in this field, and also the cooperative participation of academia, government and industry.

Scientists from Vietnam, Indonesia, Sri Lanka , Thailand and several other Asian countries attended the workshop.

Future Actions Committee.

COCI chairman Albert Fischli proposed further activities of COCI including:

1 Organization of 4th IUPAC Workshop on Safety in Chemical Production in Near East-Asia;

2 Organization of an IUPAC Workshop on Safety and Environmental Protection in Food Production;

3 Elaboration of recommendations for governments which will be useful as scientific inputs for legislation;

4 Establishment of an IUPAC–UNESCO–UNIDO fellowship programme for safety and environmental protection in the production of chemicals and pharmaceuticals.

Most of the ensuing discussion focused on item 4.

After adjournment of the ten parallel sessions, a plenary session entitled 'Overview and recommendations' was held under the chairmanship of Prof. Y. Uehara. Presiding officers of each parallel session presented a progress report. Finally, a draft of the 'Recommendations' of the Future Actions Committee was submitted for discussion and unanimously approved.

Support

Pacifico Yokohama is at the centre of the newly developed area of Yokohama Port which was opened in the middle of the 19th century as one of the oldest international ports of Japan. The international Convention Centre was built in 1991, and provides every necessary facility for meetings of up to 10 000 persons. A port festival was held during the workshop and participants enjoyed a large-scale firework show in the evening.

Three quarters of the total expenses were covered by financial support from Kanagawa Prefecture, Yokohama and Kawasaki City, seven benevolent foundations and 72 industrial companies. Many societies including the Chemical Society of Japan, the Society of Chemical Engineering and the Japan Chemical Industry Association gave immeasurable support both mentally and financially.

The workshop proceedings will be published by Blackwell Scientific Publications within a few months. This paperback book will contain details of each invited lecture and the keynote lectures from all sessions as well as the recommendations.

Recommendations

Recommendations of the 2nd IUPAC Workshop on Safety in Chemical Production, Yokohama, Japan, 31 May – 4 June 1993.

Rationale

The goal of the organizing committee was to offer an opportunity for leaders from academia, government and industry to:

- critically examine current practices;
- exchange ideas and experiences; and
- discuss important issues with respect to safety and environmental protection

The committee also recognized the importance of hands-on experience and extended these discussions outside the formal meeting into neighbouring plants.

Chemistry is the fundamental basis for all life. Chemistry and chemical technology are not only essential for the maintenance and improvement of every day life, but they are also vital for the continuation of technological advancement based upon progress in fundamental research. Risks associated with the production of chemicals have to be maintained at the lowest tolerable level in order to protect mankind, the global environment and to ensure sustainable development.

Adequate safety management of the whole product life cycle including research and development, production, transport, storage, consumption and final disposal is urgently required. Such management and stewardship is the common responsibility of academia, government, industry and consumers in both developed and developing countries.

The following recommendations have been put forward by the organizing committee of the 2nd IUPAC Workshop and ratified by the conference, It is expected that they will be transmitted by the participants to influential opinion makers world wide, They will also be distributed within the IUPAC network.

Risks associated with the production of chemicals have be maintained at the lowest tolerable level in order to protect mankind, and to ensure sustainable development.

Measures for chemical safety and environmental protection in production and research

Appropriate measures for chemical safety in production and research may be described by a structure interconnecting the five following elements: chemicals, facilities, procedures, human factors and management.

Chemicals

Any person using chemicals in industrial and academic research organizations should foresee, and assess all possible hazards including those which endanger mankind, the environment, and the production facilities. Appropriate measures should be taken to control all hazardous situations.

Facilities

All the facilities and apparatus for research, production, storage, loading/unloading, transportation, treatment, use and disposal should be designed and engineered to reduce the risks of chemicals and processes. They should be manufactured, constructed, operated, maintained and inspected with special attention.

Procedures

The effective control of hazardous materials requires an ongoing commitment to the principles of process safety management. This is defined by the conference as the application of systems and controls (including programs, procedures, audits and evaluations) to a manufacturing or chemical process in a way that incidents arising from process hazards are prevented.

Human factors

The personnel should be educated and trained to recognize potential hazards, to follow related operating manuals and to understand emergency procedures. The individuals must take responsibility for their own actions towards corporate goals. They should be motivated to propose 'bottom up' activities and show voluntary commitment towards furthering safety and environmental protection.

Personnel should be educated and trained to recognize potential hazards, to follow related operating manuals and to understand emergency procedures

Management

Managers at all levels are responsible for the administration of chemicals and facilities. They should recognize the hazards of chemicals, facilities as well as characteristics of human behaviour. They should be committed to the active implementation of integrated safety, and environmental management. They should pay attention to the philosophy that safety and environmental protection should be given top priority.

Cooperation for loss prevention and environmental protection

Cooperation between academia and industries

Academia has a vital role to play in partnership with industry. Course design, delivery and evaluation should best meet the needs of industry and embrace the existence of academic expertise in safety and environmental protection. Academia should also adopt appropriate safety and environmental protective measures within the own research domain.

Cooperation among industries

Industries should exchange data pertinent to safety and environmental protection. This information should include details (inter alia) of safety management policy, new safety technology and hazardous events. They should also cooperate to promote their principals of 'Responsible Care' towards their products over the whole life cycle. Such cooperation requires industries to provide appropriate information in an internationally accepted format.

Cooperation between industries and government

Government and industry should make concerted efforts to maintain a close relationship. This will enable all governments to produce appropriate legislative instruments for safety and environmental protection and to further ensure the exchange of information.

International cooperation

Developed and developing countries should cooperate to promote the exchange of information concerning safety management and environmental protection including details of hazardous events. International measures should be taken to promote appropriate training, e.g. by establishment of international training centres.

Training atmospheric scientists in developing countries

Jack G. Calvert

Many countries in the world today have little, if any, expertise in atmospheric chemistry. Yet there are several international observational programmes which involve the developing countries; these are often designed to track the changing composition of the atmosphere and detect significant changes which continue to occur. The success of these programmes depends upon the availability of highly motivated, well-trained scientists in the developing countries in which measurements are required. A review of the brief history of the international training programmes in the atmospheric sciences is given here. A plan is outlined to solicit highly qualified scientists (atmospheric chemists, physicists, meteorologists, dynamicists, engineers, modellers, etc.), both in developed as well as developing countries, to volunteer as partners in the formation of an international team of teachers who can be called upon to help design and offer specific courses that will be key ingredients in the continued training of the cadre of scientists involved in international measurement programmes.

Prof. Jack G. Calvert (Atmospheric Chemistry Division, National Center for Atmospheric Research, Box 3000, Boulder, CO 80307, USA) was Chairman of the IUPAC Commission on Atmospheric Chemistry, 1987–89.

Introduction

Interest of the IUPAC Commission on Atmospheric Chemistry (CAC), in the continued development of programmes for the training in atmospheric chemistry of young scientists from developing countries has been stimulated by several activities of the Commission and of the atmospheric science community as a whole. The need for highly motivated and well-trained scientists in the field of atmospheric chemistry, particularly in developing countries, continues to grow as various new global measurement programmes evolve.

The long history of international programmes of research and monitoring of the atmospheric composition had its origin over 60 years ago, when a network for global total ozone measurements was initiated. During the 1950s, a European network for the Chemical Composition of Air and Precipitation was also established, and has provided the first overview of regional air pollution problems. In recent years this network has been supplemented by the European Experiment on Transport and Transformation of Environmentally Relevant Trace Constituents in the Troposphere over Europe (EUROTRAC) and Co-operative Programme for Monitoring and Evaluation of the Long Range Transmission of Air Pollutants in Europe (EMEP).

During the period 1957–59, the International Geophysical Year (IGY) stimulated the first global multiphase, multispecies study of atmospheric composition of precipitation, radionuclides and many trace species; observatories were set up to determine the background levels of CO_2, O_3 and aerosols. The observation programme continued to grow during the past three decades largely through the leadership of the World Meteorological Organization (WMO), through its 160 member countries; they have been involved in baseline and regional monitoring of the chemistry of the atmosphere and related physical parameters. Two programmes, The Background Air Pollution Monitoring Network (BAPMoN) and The Global Ozone Observing System (GO3OS), formed the basis of this programme. In 1972 the Stockholm Conference on the Human Environment gave impetus to the initiation of the Global Environmental Monitoring System (GEMS) by the United Nations Environment Programme (UNEP).

In 1984 a committee of the US National Academy of the Sciences published a report *Global Tropospheric Chemistry: A Plan for Action,* which focused attention on the growing need for studies to understand atmospheric trace gas trends and perturbations which these might induce. A subsequent report of this body (1987), *Global Tropospheric Chemistry: Plans for the US Research Effort*, stimulated further research interests in our understanding better the global tropospheric chemistry.

In early 1980s the International Council of Scientific Unions (ICSU) began development of the International Geosphere—Biosphere Programme (IGBP). Independently in 1983 the International Association of Meteorology and Atmospheric Physics (IAMAP) through its Commission on Atmospheric Chemistry and Global Pollution (CACGP) began discussion which culminated in a 1986 Stockholm meeting and agreement to coordinate the development of the International Global Atmospheric Chemistry Programme (IGAC). The international planning of the actual IGAC programme began in Dookie, Australia (1988).

In the 1980s IUPAC established a Commission on Atmospheric Chemistry (VI-4). The goals of the Commission on Atmospheric Chemistry are multiple: (i) to identify problems related to the chemistry of the atmosphere and to advise and cooperate in international activities designed to address these problems; (ii) to review and harmonize the terminology, sampling and analytical procedures used in the study of atmospheric chemistry; (iii) to cooperate with other international organizations which are concerned with research in atmospheric chemistry.

Various commissions of IUPAC promote education in various areas of science. The Commission on Atmospheric Chemistry is expected to participate actively in the education of young scientists, particularly in developing countries, through position papers, workshops, and other international educational activities. It was in view of this background that a feasibility study 'Training in atmospheric chemistry for the young scientists form the developing countries', was initiated by CAC in 1991. The experience of Commission VI-4 in the design of workshops for training of the scientists from developing countries has been somewhat limited, but that which exists, coupled with an active input from many international scientific organizations and interested atmospheric scientists, appears to offer the promise of successful operations in the future.

Previous CAC experience in training young scientists from developing countries

The CHEMRAWN VII Workshop

The Commission on Atmospheric Chemistry was designated as the Planning Committee for the CHEMRAWN VII Conference 'The Chemistry of the atmosphere: its impact on global change', which was held in Baltimore, USA, in December 1991. As one result of its considerations, the commission suggested that a workshop be organized for the young scientists of the developing countries within the CHEMRAWN VII activities. A Workshop Committee, chaired by Dr William E. Wilson (Senior Science Advisor, US Environmental Protection Agency) was appointed to organize a workshop which would give a general background to the methods involved in air monitoring of harmful pollutants and in protecting the environment. This particular workshop was structured around two of the US Environmental Protection Agency's standard training courses: (1) Atmospheric sampling; and (2) Quality assurance for air pollution measurement systems. The material in these courses is applicable to both health-related and global climate pollutants.

The atmospheric sampling course included lectures and laboratory work on the design of air quality surveillance networks, criteria for selecting monitoring sites, the basis for selection of sampling methods and instruments, methods of calibration and the use of flow rate measuring methods for sampling and analysing criteria pollutants. Laboratory work included measurement and calibration of flow devices, preparation of calibration gas flows via dilution and permeation systems, and calibration of continuous and passive monitoring devices. The course also included experience with high volume samplers, dichotomous samplers, and other types of samplers that separate particles into fine, coarse, and respirable fractions. Scientists from several agencies discussed ways for developing countries to participate in research and monitoring related to global warming and stratospheric ozone destruction. The workshop, coupled with the CHEMRAWN VII Conference, provide an excellent opportunity for young chemists and other scientists from developing countries around the world to interact with experts in the field of atmospheric chemistry.

CHEMRAWN VII Conference, Baltimore, December 1991.

Dr Nyle C. Brady (UNDP).

In conjunction with Dr Nyle C. Brady (Senior Consultant, United Nations Development Programme, UNDP), Prof. Cyril Ponnamperuma (Department of Chemistry, University of Maryland) and Dr William Wilson (US, EPA) funds were raised from the Division of Global and Interregional Programmes of UNDP and which allowed 25 participants from representative developing countries to travel to an Air Pollution Workshop which was held on 18–29 November 1991 at Rutgers University Air Pollution Training Center. In general the students had very positive comments concerning the value of the workshop and the subsequent CHEMRAWN VII Conference which they attended.

At the time of the CHEMRAWN VII Conference, the present author, who served as programme chairman for the Programme Committee of the Conference, canvassed the large international group of scientists who participated, and he found an almost unanimous willingness to serve as volunteers for future atmospheric chemistry training programmes throughout the world. It is clear that the formal organization of such a programme, in cooperation with the major international scientific bodies concerned with the global atmospheric measurement programmes, is a very feasible endeavour which should be pursued actively by the scientific community.

Specific workshops in various countries

Several of the members of Commission VI-4, and many other atmospheric scientists from around the world, have participated in other international workshops which have occurred in recent years in China, Mexico, Taiwan, and many other countries. Very often these workshops involved rather distinctive formats which were tailored to meet the specific needs recognized by the organizers in the developing country and the faculty participants. They usually consisted of

Prof. Mario Molina (MIT).

various combinations of lectures and discussions with the attendees.

One of this nature was organized by the faculty of the UNAM University (Mexico City) in conjunction with Dr Mario Molina (Professor at Massachusetts Institute of Technology, USA) and faculty members from several universities. This was called the International Workshop on Environmental Atmospheric Chemistry and was held in January 1991 in Mexico City. It focused upon topics related to the very large air pollution problems in Mexico City and involved young Mexican scientists from universities, industry and government laboratories. In this case, 6 days of lectures were arranged and presented. The workshop was designed to include several site visits and round table discussion of particular problems identified by the participants. Many positive responses to this workshop were obtained from its over one hundred attendees, and a second workshop is planned for Mexican scientists during 1993.

Possible current international projects for which CAC and the atmospheric science community may play a training role

The Global Atmosphere Watch

In 1989, The Global Atmosphere Watch (GAW) was approved and integrated BAPMoN and GO3OS with meteorological aspects of long range transport/ deposition and other related programmes. GAW activities are normally implemented in the territories of participating member countries under the responsibility of and by the countries themselves and must be supported as far as possible from the countries own resources. Mauno Loa, Cape Grim, and Alert are AGW baseline stations that follow this pattern along with regional stations such as Caribou (Maine), Schauinsland (Germany) and many others. However in the case of developing countries, partial support has been provided by or through the WMO by other member countries or other organizations (e.g. UNEP, UNDP). The main role of WMO is to promote, based on the wishes of its members, a programme of world-wide coordination and standardization of atmospheric measurements and their evaluation.

Inter-American Institute (IAI) for Global Change Research

At the First Workshop for the Development of an Inter-American Institute for Global Change Research held in Puerto Rico in July, 1991, it was determined that IAI should address regional problems which include: the conduct and support of basic research; the collection and management of data; promotion on the development of human resources; and development of public policy concerns relevant to global change. The stated principles which should guide the evolution and development of the IAI were the following: scientific excellence; relevance to regionally defined issues; *contribution to education and training*; promotion of standardized data and information exchange; and cooperation. In further definition of the third of these principles, the planners noted that all countries are in need of a new cadre of scientists able to function in a truly interdisciplinary fashion and able to communicate effectively with local and national policy makers, as well as with the international scientific community. A Second Workshop for the Development of the Inter-American Institute for Global Change Research was held in Argentina during 1992, and a planning document has been developed in which the IAI has been conceived of as a network which includes an Institute Directorate and a number of Research Centers which will conduct and sponsor basic research on global change processes which are of special importance to an, in some cases unique to, the Americas.

The long-term objectives of the CHEMRAWN Global Monitoring Plan include monitoring the chemical evolution of the contemporary global atmosphere in order to assess the impact of human activities.

CHEMRAWN Global Monitoring Plan

Discussions of future needs for the atmospheric chemistry, world-wide community at the recent CHEMRAWN VII Conference, led to a suggestion of Dr Paul Crutzen, Director of the Max-Planck-Institut für Chemie; a possible new role was suggested for the chemical industry in facilitating the world-wide atmospheric chemistry measurement programme. Dr Eldon E. Ferguson, Director of the Climate Monitoring & Diagnostics Laboratory, National Oceanographic and Atmospheric Administration, Boulder, CO, and Dr Rudy Pariser, member of the CHEMRAWN Committee and former employee of the du Pont de Nemours Company of Wilmington, Delaware, are currently chairing a committee of scientists who are investigating the possible roles which could be played by industry throughout the world in helping the global measurement programmes,

The long-term objectives of the proposed study are: (1) to monitor the chemical evolution of the contemporary global atmosphere in order to assess the impact of human activities. This includes the elucidation of greenhouse gas budgets, growth of aerosols, and changes in the oxidative capacity of the atmosphere, all of which influence the earth radiation balance and climate; (2) through collaboration between science, industry, and government, to contribute to the creation of a community of people working toward the common goal of understanding how human activities are affecting our planet's atmosphere. The short-term objectives focus on pilot projects that increase the number and quality of observations from large areas of the globe where currently almost no measurements are being made.

The efforts of the CHEMRAWN Global Monitoring Plan should be complementary to, and coordinated with those of the Global Atmospheric Watch Programme of WMO. The organizers visualize the role of industry in the pilot projects to be varied from case to case; it may include: (1) the supply of space on sampling platforms (e.g. ships or aircraft); (2) personnel taking part in the sampling and / or data interpretation; (3) financial support of a certain project or travel of personnel from developing countries to training workshops and courses.

Possible agenda for training of young scientists from developing countries

Formation of a pool of atmospheric scientists capable and willing to participate in the education of scientists from developing countries

In cooperation with the various international scientific bodies involved in atmospheric measurement programmes, CAC wishes to advertise to the international scientific community the opportunity to serve as a participant in the programme. We encourage participation of those of high credentials and experience from the university, industry, government, and private atmospheric research groups to respond to the request for volunteers which accompanies this report. It is anticipated that travel and living expenses will be provided by some appropriate sponsor, including agencies of government, industry, international organizations, and private persons or foundations. The work of the atmospheric scientists will be voluntary, and no consulting fees or other compensation will be given for participation. The list of experts will be continually revised to include the new talent as it is required for special projects. The list of potential participants should be large (hundreds) so that the time required from each individual should be minimized , and that the teaching effort can fit into the already busy schedule of these active scientists.

Handling of requests for help in organization of a training session or workshop

The discussions of implementation of an active training programme for scientists in the developing countries have culminated in recent meetings at the Fraunhofer-Institut für Atmosphärishe Umweltforschung (IFU), Garmisch-Partenkirchen, Germany. These involved representatives from several atmospheric science related groups, including the International Global Atmospheric Chemistry Core Project (IGAC), the American Geophysical Union, the World Meteorological Organization, and others. The Meetings, hosted by Prof. Wolfgang Seiler, Director of the IFU, were co-chaired by Dr John M. Miller, Chief of the Environmental Division of the WMO, and Prof. Volker A. Mohnen, the State University of New York at Albany. Dr Eugene W. Bierly, Director of the Office of education and Research of the AGU, volunteered the services of his office in compiling a comprehensive list of scientist-volunteers to serve as instructors for an international educational programme of workshops and various training programmes for the developing countries.

Information which will be collected in the databank will summarize the potential availability, areas of expertise, language skills, etc., of each scientist volunteer; this information will be provided to the appropriate contacts in the developing countries and to the several scientific bodies involved in international research programmes (including IGAC, WMO, etc.) as requested to satisfy specific needs. A scientist in developing country may communicate with the organizing office and seek help in designing a training programme or workshop in some desired area of atmospheric chemistry (monitoring of

Specific plans are being formulated to implement a programme dedicated to training scientists within developing countries in aspects of atmospheric chemistry.

specific pollutants, planning site locations, etc.) through procedures which are now being defined. A committee of members representing the various interested scientific organizations (IUPAC, IGAC, WMO, etc.) will consider the needs, communicate with the interested scientists, and in collaboration with these scientists, arrange a suitable programme and participants which will satisfy the identified needs for training.

Support for the training programme

Support of this programme will be sought from national and international agencies, industry, private organizations, and the developing countries themselves. The detailed procedures for the operation of the new training programme are now under active development by the various scientific groups (IGAC, AGU, WMO, IUPAC, etc.) who are participating in the programme.

A programme dedicated to training of scientists within developing countries in aspects of atmospheric chemistry is judged to be very important to our progress in detecting changes in the composition of the global atmosphere. Specific plans to implement this programme are now being formulated by the participants from several of the major international atmospheric science organizations. This programme will be structured to satisfy the identified needs which now exist. It is clear that the first step in achieving our stated educational goals for the training of atmospheric scientists in the developing countries is the compilation of a list of potential faculty for the programme. If you are a highly qualified atmospheric scientist with a strong interest in helping in the development of the world-wide atmospheric science community, we urge you to fill out and return the application which follows this report. We in the atmospheric science community thank you in advance for your interest and support of this important programme.

Announcement for atmospheric chemists

Would you be willing to spend several weeks during the next several years helping in the formation of a core teaching facility to assist in the training of atmospheric scientists and technicians in developing countries?

There are many countries in the world that have little, if any, expertise in atmospheric chemistry. Yet, there are several international programmes the success of which depends on the availability of a trained and educated cadre of scientific partners in the ever expanding network of monitoring stations, international field programmes, and in the interpretation of large data sets that are generated by numerous activities in atmospheric science areas throughout the world. The International Geosphere–Biosphere Programme's (IGBP) International Global Atmospheric Chemistry (IGAC) Core Project and SysTem for Analysis, Research and Training (START) Activity plus the World Meteorological Organization's Global Atmosphere Watch (GAW) all have needs of varying degrees for atmospheric chemists. They are all placing increasing demands upon the scientific community for the development of new scientific partnerships among the developing and developed countries and also on the infrastructure that facilitates the attainment of reliable data and its interpretation. It is clear that well designed and carefully monitored education programmes are required now to train scientists at all levels for participation in such programmes. The initial efforts will be in support of the new GAW baseline stations that are to be set up in Algeria, Argentina, Brazil, China, Indonesia and Kenya.

The global atmospheric sciences community has banded together to solicit highly qualified scientists (atmospheric chemists, physicists, meteorologists, dynamicists, engineers, modellers, etc.), both in developed as well as developing countries, to volunteer as partners in the formation of an international team of teachers who can be called upon to help design and offer specific courses that will be required in these training programmes. The training courses will vary from short instructional lectures and workshops to extended courses in the atmospheric sciences. It is anticipated that a given faculty volunteer will be called on only infrequently and that a schedule will be agreed upon by both the faculty person and others involved in the course organization. Usually the time required will be a 1–2-week period. Travel and living expenses of the faculty member will be paid by supporting agencies, but no financial compensation for the faculty member's time will be possible.

Considerable experience has been gained through the involvement of the atmospheric sciences community in previous international workshops and courses in recent years. This experience suggests to all that the successful development and scientific growth of a cadre of atmospheric scientists throughout the world will require the active participation of a major part of the atmospheric sciences community. Atmospheric scientists in universities, government and private research institutes and laboratories as well as those in industry, are encouraged to join this volunteer effort by returning the information reprinted below. This information will be entered into a data base that will provide a listing of possible faculty for potential involvement in future courses and workshops. The return of the application does not constitute a firm commitment by the volunteer, but it shows your interest in participation in specific opportunities which may arise in the near future.

This programme has been discussed with representatives of the following organizations and groups. Discussions do not imply concurrence by that organization, but rather that a communication link does exist.

- International Geosphere–Biosphere Programme – International Global Atmospheric Chemistry Core Project (IGAC)
- International Geosphere–Biosphere Programme – System for Analysis, Research and Training (START)
- Inter-American Institute (IAI)
- American Geophysical Union (AGU)
- International Union of Pure and Applied Chemistry (IUPAC), Commission on Atmospheric Chemistry (VI-4)
- Executive Committee of the World Meteorological Organization (WMO)
- Commission on Atmospheric Science (CAS) of the WMO.
- Global Environment Monitoring System (GEMS) of the United Nations Environmental Programme (UNEP)
- International Association of Meteorology and Atmospheric Physics (IAMAP), Commission on Atmospheric Chemistry and Global Pollution (CACGP)

International Programme for Training of Atmospheric Scientists

Yes, I am interested in participating in the international programme for the training of atmospheric scientists and provide the following information which will be added to the data base related to this activity:

NAME . . . .

AFFILIATION . . . .

ADDRESS . . . .

. . . .

. . . .

. . . .

TELEPHONE . . . .

FAX . . . .

E-MAIL ADDRESS . . . .

AREAS OF EXPERTISE IN WHICH PARTICIPATION AS A COURSE INSTRUCTOR/LECTURER IS POSSIBLE (in order of preference):

(1) . . . .

(2) . . . .

(3) . . . .

TEACHING EXPERIENCE THAT WOULD BE RELEVANT TO THE GAW NEEDS:

. . . .

. . . .

. . . .

LANGUAGE ABILITIES: . . . .

. . . .

TIME PERIODS DURING THE YEAR WHICH YOUR AVAILABILITY IS MOST CONVENIENT TO YOU AND EMPLOYER:

. . . .

. . . .

. . . .

AREAS OF THE WORLD IN WHICH YOU WOULD BE PREPARED TO INSTRUCT:

. . . .

. . . .

Please mark this for the attention of:

Dr Eugene W. Bierly, Director, Education & Research
AMERICAN GEOPHYSICAL UNION,
2000 Florida Ave., NW
Washington, DC 20009
USA,

The NO_2 problem in Japan

Hajime Akimoto

This is the second in a series of articles on regional environmental problems prepared by members of the IUPAC Commission on Atmospheric Chemistry.

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Why is the ambient concentration of NO_2 not decreasing in Japan? This is one of the important environmental questions currently under investigation in the country.

Regulations for NO_x emissions, which were first enacted in 1973 for both stationary sources and automobile exhausts, have been strengthened step by step in Japan over the past two decades. The reasoning for NO_x emission control is twofold. First, NO_x is a precursor to toxic photochemical oxidants and second, NO_2 itself has adverse effects on human health.

However, an Environmental Quality Standard (EQS) has only been set for NO_2 and not for NO and NO_x in Japan. An EQS is defined as a desirable and attainable ambient level. The EQS for NO_2 is the range 0.04–0.06 p.p.m. or less for the daily average of hourly values.

The priority, in regard to the administrative effort in Japan, is to keep NO_2 levels below this EQS level rather than reduce total NO_x concentrations. In other words, the control of total NO_x emissions is seen to be necessary in order to reduce NO_2 levels below the EQS level.

Figure 1 shows the annual average concentrations of NO and NO_2. These were determined at roadside automobile exhaust monitoring stations and general air pollution monitoring stations which have been in continuous operation since the early 1970s. Figure 1 (a) shows a gradual decrease in NO concentrations for the period 1971–85 for both roadside and general monitoring stations. In contrast, Fig. 1 (b) shows that NO_2 concentrations only decreased during the early 1980s and then only marginally. It should be noted that both NO and NO_2 concentrations have increased since 1986. This is possibly due to an increase in emissions from automobile traffic.

In 1987, readings of NO_2 concentrations at about 1300 general air pollution monitoring stations and 290 roadside exhaust monitoring stations exceeded EQS levels by 6.0% and 37.4%, respectively[1]. The fact that environmental criteria for NO_2 in large cities were not achieved, even at the non-roadside general air pollution monitoring stations, is a serious local atmospheric environmental problem in Japan.

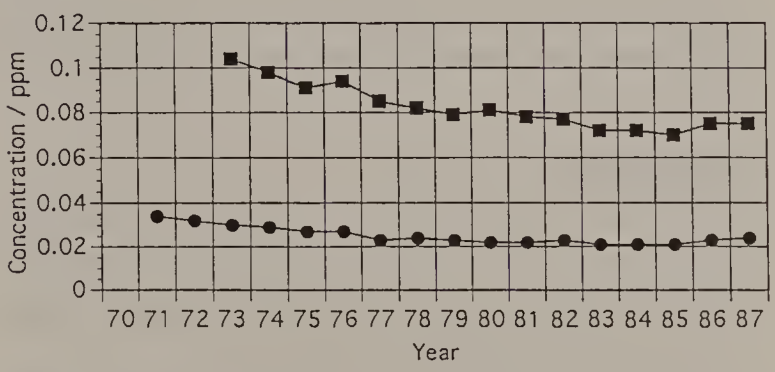
From the atmospheric chemistry point of view, it is a matter of concern that the NO_2/NO ratio continued to increase throughout the 1970s and early 1980s. This is shown in Fig. 1(c). Oxidation of NO to NO_2 in the atmosphere is thought to occur through the following two processes involving (a) volatile organic compounds (VOCs) and (b) ozone:

$$
\begin{array}{lll}
\text{(a)} & \text{VOC} + \text{OH} \rightarrow \text{RO}_2 + \text{products} \\
 & \text{NO} + \text{RO}_2 \rightarrow \text{NO} + \text{RO} \\
 & \text{RO} + \text{O}_2 \rightarrow \text{HO}_2 + \text{carbonyl compounds} \\
 & \text{NO} + \text{HO}_2 \rightarrow \text{NO}_2 + \text{OH} \\
\text{(b)} & \text{NO} + \text{O}_3\,(\text{background}) \rightarrow \text{NO}_2 + \text{O}_2
\end{array}
$$

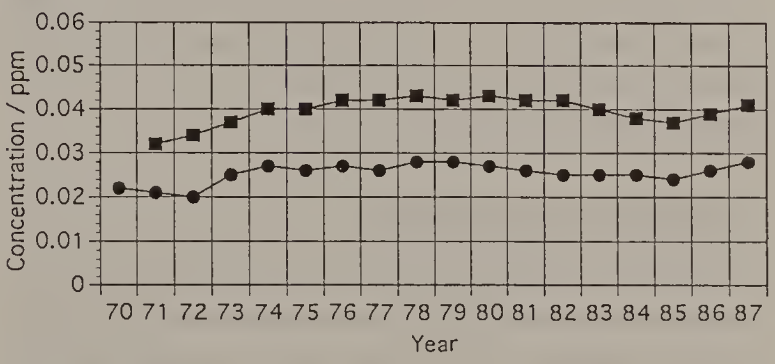
Process (a) is a well-known photochemical scheme for the oxidation of NO to NO_2 leading to the generation of photochemical oxidants. Process (b) represents the oxidation of NO to NO_2 by background O_3. This is ozone which flows into and mixes with the polluted urban plume.

It is difficult to envisage the enhancement of process (a) as a cause of the increase of the NO_2/NO_x ratio during the 1970s and early 1980s. This is because the ambient concentrations of VOCs which catalyse atmospheric oxidation of NO to NO_2

(a) NO



(b) NO_2



(c) NO_2/NO

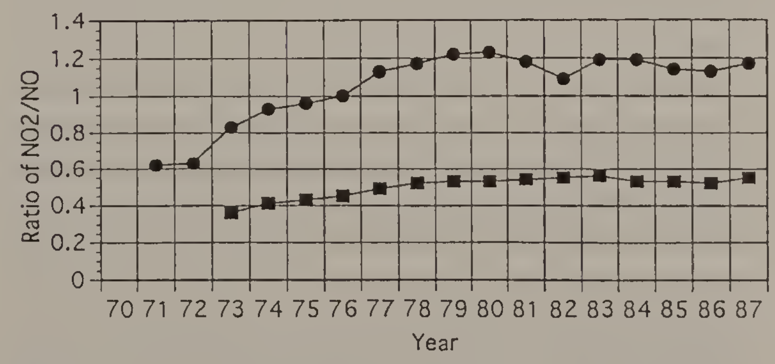


Fig. 1 Concentrations of (a) NO and (b) NO_2 and (c) ratio of NO_2 to NO at roadside stations (■) and general stations (●). Source JEA (1990).

did not increase during this period. On the other hand, according to analysis of ozone data[2], background tropospheric ozone concentrations in the boundary layer in Japan have increased by 8–10 p.p.b over a decade spanning the 1970s and 1980s.

Whilst more detailed analysis of the cause of the increased NO_2/NO ratio is necessary, the above findings suggest that the local atmospheric NO_2 problem in Japan may be strongly coupled to the regional tropospheric ozone increase in East Asia.

Traffic in the centre of Tokyo. Concentrations of both NO and NO_2 have increased since 1986, possibly due to increased automobile emissions.

References

1 Japan Environment Agency (JEA), *Quality of the Environmental in Japan, 1989,* Planning Division, Global Environment Department, Tokyo, 1990.

2 H. Akimoto, H. Nakane, Y. Matumoto, 'Tropospheric ozone trend at selected sites in Japan', Paper presented at the CHEMRAWN VII Conference on The Chemistry of the Atmosphere: It's Impact on Global Change, CHEMRAWN VII, Baltimore, USA, December 1991.

Chemistry on the Internet

Yecheskel Wolman

This article, commissioned by the Committee on Chemical Databases (CCDB), describes some of the Internet services and resources which are of interest to the chemical community.

Introduction

Since the end of 1992, the IUPAC Secretariat in Oxford has been connected to the Internet. Members of the Union can therefore communicate electronically with the Secretariat by sending e-mail to **iupac@vax.oxford.ac.uk**.

Internet is much more than a computer network for electronic communication. It has many other uses not only for the general public but also for scientists in particular. We shall discuss here what Internet is and how it helps the chemist in many aspects of his daily work.

Three basic applications

Internet (with a capital I) is the international network of networks based on the TCP/IP (Transmission Control Protocol/ Internet Protocol). Three basic applications are defined by the TCP/IP – electronic mail, better known as e-mail (SMTP – Simple Mail Transfer Protocol); remote login (Telnet) and file transfer (FTP – File Transfer Protocol).

During the last 18–24 months Internet has been growing at a monthly rate of 8–10%. Because of its rapid growth it is difficult to obtain solid statistics concerning its size. However, by the middle of 1993 the network covered about 10 000 networks in over 60 countries linking over 1 200 000 computers with an estimated number of over 30 000 000 users[1].

A detailed description of Internet, as well as its usage and the various applications of TCP/IP can be found in one of the many books on the topic published during the last two years. Excellent basic information can be found in Kehoe's *Zen and the Art of the Internet*[2] or in *Internet: Getting Started* by Marine *et al.*[3] Those interested in more advanced information should use Krol's guide *The Whole Internet.*[4]

Extensions to electronic mail

Electronic mail is the most popular service on Internet. It is used to write, send and receive text messages. This modern method of communication has both benefits and shortcomings. For example, it is easy to forward a message and reply to it. On the other hand, once the message is sent it is impossible to retrieve it.

While e-mail is a one-to-one informal communication channel, various 'extensions' are available. The most widely known is the electronic discussion group. The electronic discussion group is a group of users who have a common interest and share their ideas, opinions, problems and solutions by means of electronic mail. Internet users can 'subscribe' to the group. All messages sent to the discussion group are distributed automatically to all subscribers.

The best known type of a discussion group is LISTSERV. This software electronically distributes messages and archives them in a way that they can be searched and retrieved. The following are some of the chemistry discussion lists:

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- CHEMED-L (chemical education)
- CHMINF-L (chemical information)
- CHEMISTRY (computational chemistry)
- ICS (chemometric)
- CORROS-L (corrosion)
- FORENS-L (forensic sciences)
- IFPHEN-L (interfacial phenomena)
- SAFETY (chemical safety and hygiene)

One should remember that while messages are sent to the discussion list, commands are sent to LISTSERV. LISTSERV is also used for searching and retrieval of messages and files.

Another approach for exchange of information on Internet is provided by UseNet which is composed of various news groups arranged hierarchically and used for browsing and reading news on a specific topic. News groups which are of interest to chemists are **sci.chem** and **sci.eng.chem.**, for example.

Mail servers

There are various mail servers which contain valuable information. One example is the Springer server (**svserv@ dhdspri6.bipnet**) which obtains by return e-mail lists of forthcoming papers in some of Springer's journals as well as lists of new books. The server also contains: cumulative volume indexes to *Topics in Current Chemistry* and *Structure and Bonding*; table of contents of *Landolt-Boernstein* and *The Enzyme Handbooks*; and macros for $\TeX$. A list of accepted papers for some of Elsevier's chemistry journals can be obtained by e-mail from Elsevier server **vonk@elsevier.nl**.

Workshops and conferences

E-mail is also used for remote teaching and electronic conferences. In November and December 1992, an on-line workshop on 'Navigating the Internet' took place with 15 000 participants. An on-line chemical education conference on 'Applications of technology in teaching chemistry' was held during the months of June to August 1993[5], with about 400–450 participants. Another electronic conference on 'Chemometric' is scheduled for the summer of 1994.

Remote login

Telnet or remote login allows a user to connect to a remote computer and use it as if the local computer is a terminal of the remote machine. It results in an interactive session in which the local machine is transparent. The user works as if he or she were directly connected to the remote machine. Using the remote login, the user can connect to a machine. Prior permission to use that machine is required together with a user name and a password. It is also possible to connect to 'open' databases and information systems such as on-line public catalogs (OPACs) and campus wide information systems (CWISs). Various commercial databases vendors are connected to Internet (for example: STNC, Dialog and Data-Star)[6].

The advantages for the end user and/or the information specialist using Internet are twofold: higher working speed and lower communication costs. The high working speed results in shorter connection times (and lower costs). Saving on communication costs is very moderate in a local connection, but may be 80% or more on international connections.

Statistics, newspaper indexes, full text journals and magazines, chemical databases, book publishers and bookstore catalogues, library catalogues as well as many other items are available at various OPACs. Some of the items are restricted to a specific group or groups of users (one just needs a password in order to search them). Others are open to the general public.

Among the non-commercial databases which are open to the public and are of interest to chemists is the Chemical Safety Hazardous file. This covers various properties such as flammability, corrosivity, carcinogenicity, toxicity and regulatory listing. The file is located at Stanford University, USA. Another is the Buckyball Database which contains a bibliography and background material on the chemistry and physics of buckyballs. It is available from the University of Arizona library in the USA. Other databases which are located on Internet, open to the public and chemical oriented are: The EPA-Online library system, the Genome Database, the Protein Databank and the MSDS collection. The tendency is for more and more local non-commercial databases to be maintained on Internet and become open to the public.

Other items which are mounted on Internet are organic reaction data bases and/or synthesis planning packages. These items are available to organic chemists in Dutch universities via the CAOS/CANN Center and to chemists in British universities via the Daresbury Laboratory Computer Center.

Recently, more and more document orders have been carried out over Internet by the end user and/or the librarian (for example, through Uncover, CASDDS, and ISI-Genuine Article Service).

File transfer

FTP is an application program that moves files between computers which are on Internet using the File Transfer Protocol. There are many text and binary files on various computers on Internet which are of interest to chemists. Whilst most of them are free to the public, a few are chargeable. Some of the text files are the full text of the *The Scientist*, the full text of *Chemical Engineering Digest*, the supplementary material of the *Journal of the American Chemical Society*, various manuals and guides [Internet guides; online chemistry search manual (DIALOG); a manual to Moby 1.5; *Computer networks and communications: a primer for chemical educators* by T. C. O'Haver; hazmat – chemical spill emergency response, ChemWiz – all information and materials for the NCSA ChemWiz project].

There is a vast amount of computer software available for FTP transfer on Internet – some chemistry oriented, some on general applications. Demo and upgrades of commercial programs can be obtained by FTP (for example, the Demo of Moby 1.5). All quantum chemistry program exchange (QCPE) software can be obtained by FTP. Collections of chemistry tutorial for MS-DOS and Macs are available on many FTP sites. Some of them are: **wuarchive.wustl.edu**, **meap.uta.edu**, **gatekeeper.dec.com** (for MS-DOS), **ra.nrl.navy.mil**, **archives.umich.edu** (for Mac).

One should remember that Internet is a dynamic system – files may change names, be moved from one directory to another or even moved from one computer to another. Sometimes they may be deleted and removed completely from the system.

How can one find out about resources on Internet in general and about the chemistry on Internet in particular? Some help is available: Archie, Gopher, WAIS and WWW are the most well known. A lot of information, tips and help can be found in references 2–4. These also describe how to use the various means of help. And there are always people in your local computer center and/or library who are able and willing to help.

References

1 N. Anderson, *Science*, **260**, 1064 (1993).
2 B. P. Kehoe, *Zen and the Art of the Internet*, Prentice Hall, Englewood, NJ, USA (1993).
3 A. Marin, S. Kirkpatrick, V. Neou and C. Ward, *Internet: Getting Started*, Prentice Hall, Englewood,NJ, USA (1993).
4 E. Krol, *The Whole Internet: User's Guide and Catalog*, O'Reilly and Associates Inc. Sebastopol, CA, USA (1992).
5 S. Borman, *Chemical & Engineering News*, 25 (15 Feb 1993).
6. T. Keyas, *Online*, **17** (1) 29 (1993).

Internet covers about 10 000 networks in over 60 countries linking over 1 200 000 computers with an estimated number of over 30 000 000 users.

PAC Review

Pure and Applied Chemistry (*PAC*) is IUPAC's official journal. It publishes the main invited lectures of symposia sponsored by the Union; the recommendations of its Commissions on nomenclature, symbols and units, and technical reports on standardization, recommended procedures, collaborative studies and data compilations. Summaries of the most recent IUPAC recommendations on nomenclature and symbols, and technical reports appearing in *PAC* are published in *Chem. Intl.* in the section Recent Reports. In this section we take a brief look at the symposia and lectures published in recent issues of *PAC*.

Excited state electron transfer

The August 1993 issue of *Pure Appl. Chem.* contains most of the plenary and invited lectures presented at the IUPAC-sponsored International Symposium on Experimental and Theoretical Aspects of Excited State Electron Transfer and Related Phenomena held in Pułtusk, Poland, 27 September – 2 October 1992. The Symposium Editor was Stefan Paszyc (Adam Mickiewicz University, Poznań).

The following are some of the papers presented at the symposium and published in this issue of *Pure Appl. Chem.* They illustrate the international nature of the meeting.

- 'Photoinduced electron transfer and multiple states mechanisms' by Noboru Mataga (Osaka University, Japan).
- 'Scavenging of hydrated electrons by hydrophobic solutes in ionic micellar solutions' by E. Szajdzińska-Piętek, J. L. Gębicki and J. Kroh (Technical University of Łódź, Poland).
- 'Competition between tunnel and viscosity effects on biomolecular hydrogen-transfer reaction' by Uwe Kensy, Karl-Heinz Grellmann (Max-Planck-Institut für Biophysikalische Chemie, Göttingen, Germany) and Manual Mosquera González (Universidad de Santiago, Spain).
- 'Solvent cage spectroscopy' by M. Kasha, A. Sytnik (Florida State University USA) and B. Delliner (University of Dayton, Ohio, USA).
- 'Solvent effects on excited state relaxation phenomena' by Gottfried Köhler and Karl Rechthaler (University of Vienna, Austria).
- 'Exciplex mechanism of the fluorescence quenching in polar media' by Michael G. Kuzmin, Moscow University, Russia).
- 'Femtosecond electron transfer: Experiment and theory' by Alan E. Johnson, Keisuke Tominaga, Gilbert C. Walker, Wlodzimierz Jarzeba, and Paul Barbara, University of Minnesota, Minneapolis, USA).
- 'Metal ion quenching of perylene fluorescence in lipid bilayers' by D. J. S. Birch, K. Suhling, A. S. Holmes, T. Salthammer and R. E. Imhof (University of Strathclyde, Glasgow, UK).
- 'Photophysics of stilbenoid dye systems: A comparison of experiment and theory' by Wolfgang Rettig, Wilfried Majenz, Ralf Herter (Technical University of Berlin, Germany), Jean-François Létard and René Lapouyade (University of Bordeaux, France).
- 'Solvent effects on the structure of fluorescent 'exciplexes' in rigidly-, flexibly-, and non-bridged donor-acceptor systems' by J. W. Verhoeven, T. Scherer and R. J. Willemse (University of Amsterdam, The Netherlands).
- 'Solvation of TICT (Twisted Intramolecular Charge Transfer) states in solvent mixtures' by Nagwa Ghoneim and Paul Suppan (University of Fribourg, Switzerland).

Recent Reports

In this section we publish summaries of the most recent IUPAC recommendations on nomenclature and symbols and technical reports. The full texts of these recommendations and reports are published in *PAC*.

Molecular characteristics and crystalline structure of ethylene-dimethylaminoethylmethacrylate copolymers (Technical Report)

The relationship between molecular and crystalline structural characteristics of the ethylene-dimethylaminoethylmethacrylate copolymers (EDAM) was investigated and related to melt flow index MI and average gross content of DAM comonomer, in comparison with low density polyethylene (LDPE) produced by the common high-pressure radical polymerization process. Although the average molecular weight and its distribution are influenced predominantly by the polymerization conditions, DAM-content seems not to depend significantly on molecular weight according to the GPC-FT/IR measurement.

Comonomer sequence distributions were determined quantitatively with the ^{13}C-NMR spectra entirely assigned by DEPT and ^{1}H-^{13}C COSY techniques. The result suggests the alternating copolymerization tendency and surprisingly coincides with the simulation outputs based on the assumption of continuous complete mixing reactor model, using Mayo–Lewis equation and the same Q-e values as previously reported on different types of copolymers such as EVA and St·DAM (VA, vinylacetate; St, styrene).

It was confirmed by WAXD and SAXS analyses that the crystallinity X_c and the thickness of lamellar crystal ℓ_c decreased with increasing DAM-content, whereas the a-lattice and b-lattice dimensions enlarged. X_c and ℓ_c can definitely be correlated to the heats of fusion and crystallization measured by DSC. The average size of spherulites measured with light scattering photometry tends to be enlarged with decreasing molecular weight (increasing MI) and DAM-content.

This report was prepared for publication by T. Ohmae,, S. Hosoda, H. Tanaka, H. Kihara, B. Jiang, Q. Ying, R. Qian, T. Masuda and A. Nakajima, Working Party on Structure and Properties of Commercial Polymers, Commission on Polymer Characterization and Properties, Macromolecular Division, and published in Pure Appl. Chem, ***65**, 1825–1847 (1993).*

Recommended procedures for calibration of ion-selective electrodes (Technical Report)

This report presents the general methods used for calibration of ion-selective electrodes. Calibrations by metal ion buffers, serial dilution and flow procedures are discussed and compared. Comments on activity standards, concentration standards as well as on ionic strength are also presented.

This report was prepared for publication by Richard P. Buck and Vasile V. Coşofreţ, Commission on Electroanalytical Chemistry and Commission on Equilibrium Data, Analytical Chemistry Division, and published in Pure Appl. Chem, ***65**, 1849–1858 (1993).*

The use of diffusive samplers for monitoring of ambient air (Technical Report)

Diffusive monitors have been used for work-place air monitoring for many years, and in many cases have been fund to be valid and cost-effective alternatives to conventional pumped or 'active' samplers. The state of the art of diffusive sampling is reviewed briefly, with particular reference to work-place air monitoring, and the potential for using similar or adapted devices for measuring concentrations of environmental pollutants examined. In particular; can samplers be used to measure concentration levels some three orders of magnitude lower than in the work place; are blanks and sensitivity adequate? Is the sampling rate affected by concentration? What is the effect of ambient air movement? Are there sufficient validation data? Can diffusive samplers measure particulates? These questions are addressed generally and by reference to specific applications. Some conclusions are reached and recommendations made for future research.

This report was prepared for publication by R. H. Brown, Commission on Atmospheric Chemistry, Applied Chemistry Division, and published in Pure Appl. Chem, ***65**, 1859–1874 (1993).*

Glossary for chemists of terms used in toxicology (IUPAC Recommendations 1993)

The glossary contains definitions and explanatory notes, if needed, for over 1200 terms frequently used in the multidisciplinary field of toxicology. The glossary is compiled primarily for chemists who now find themselves working in toxicology or requiring a knowledge of the subject, especially for hazard and risk assessment. Many medical terms are included because of their frequent occurrence in the toxicological literature and because chemists would not normally be expected to be familiar with them. There are two annexes, one containing a list of abbreviations used in toxicology and one containing a list of abbreviations used by international bodies and by legislation relevant to toxicology and chemical safety.

This report was prepared for publication by J. H. Duffus, Commission on Toxicology, Clinical Chemistry Division, and published in Pure Appl. Chem, ***65**, 2003–2122 (1993).*

Publications

Environmental Health Criteria

The *Environmental Health Criteria Series* is published under the joint sponsorship of the United Nations Environment Programme (UNEP), the International Labour Organization (ILO) and the World Health Organization (WHO). There are now 141 titles in the series. Reports 1–86 were reviewed in the September 1990 issue of *Chem. Intl.* (pp. 197–201); Nos 87–101 in the March 1991 issue (p. 68); and Nos 102–115 in the September 1991 issue (pp. 182–186).

The following are descriptions of a selection of the more recent titles based on the WHO new book announcements.

Beryllium

Environmental Health Criteria, *No. 106, Published by WHO, 1990, 210 pp. (English, with summaries in French and Spanish), ISBN 92 4 157106 3. CHF 23.-/USD 20.70; in developing countries CHF 16.10. Order No 1160106.*

This book evaluates risks to human health and the environment posed by the use of beryllium, a brittle metal having several unique properties. Beryllium is lighter than aluminium and more rigid than steel. When used as an additive in alloys, beryllium confers a combination of outstanding properties on other metals, including resistance to corrosion, high modulus of elasticity, nonmagnetic and non-sparkling characteristics, and increased electrical and thermal conductivities. These properties have led to major applications in the electronics and microelectronics industries, in nuclear energy, and in the production of military devices, including satellites, missiles, atomic bombs, and other weapons. Beryllium has also proved its superiority as a structural material for aircraft and spacecraft, where a combination of light weight, rigidity, dimensional stability, and good thermal characteristics is demanded.

The book opens with a summary of the unique physical and chemical properties of beryllium, followed by a comparison of different methods for sampling, sample preparation, and determination, A second section, devoted to sources of human

USA
NASA
Atlantis

Beryllium has proved its superiority as a structural material for aircraft and spacecraft, where a combination of light weight, rigidity, dimensional stability, and good thermal characteristics is demanded. (*NASA photo.*)

and environmental exposure, cites the combustion of fossil fuels as the most important source of atmospheric beryllium, with coal singled out as the main pollutant source. Concerning sources of human exposure, the report notes that toxicologically relevant exposure is almost exclusively confined to the work-place. Only two applications are judged to pose a risk to the general population: mantle-type camping lanterns and the increasing use of beryllium in dental prostheses and cements. Other sections review data on kinetics and metabolism relevant to the assessment of human hazards and summarize the complex factors governing phytotoxicity and toxicity to aquatic organisms.

The most extensive section evaluates data from the large number of toxicological studies conducted in experimental animals and *in vitro* test systems. Key findings include the development of acute chemical pneumonitis in several species exposed via the inhalation route and a highly species-specific induction of pulmonary cancer. An evaluation of effects on humans, which concentrates on occupational exposures, summarizes the large number of studies documenting the occurrence of both acute and chronic beryllium disease. The review also yields clinically useful information on exposure levels, characteristic signs and symptoms, and the most reliable diagnostic tests.

In view of the controversy concerning the carcinogenicity of beryllium, particularly careful attention was given to several studies reporting a significantly elevated risk of lung cancer in exposed workers. Evidence was judged sufficient to confirm the role of beryllium in the development of human lung cancer. The report further concludes that the potential of beryllium to provoke contact allergic reactions, supported by several reports of allergic contact stomatitis in dental patients, calls for a reconsideration of the use of this metal in dentistry.

Summary Report on the Evaluation of Short-Term Tests for Carcinogens (Collaborative Study on *In Vivo* Tests)

Environmental Health Criteria, *No. 109, Published by WHO, 1990, 96 pp. (English only), ISBN 92 4 157109 8. CHF 13.–/ USD 10.40; in developing countries CHF 9.10. Order No 1160109.*

This report summarizes the methodology and findings of a large international collaborative study designed to establish the most useful short-term *in vivo* tests for confirming the mammalian genotoxicity and carcinogenic potential of chemicals. In view of the importance of the study, key findings have been summarized and interpreted in an effort to make this information accessible to the largest possible audience.

The study, which involved the collaboration of ninety-seven investigators from sixteen countries, evaluated some fifty different *in vivo* techniques. The objective of the study was to generate a comprehensive data profile from a broad range of short-term test procedures as a means of understanding how various genetic end-points in key target tissues respond to chemicals defined as genotoxic *in vitro.* Noting that short-term assays offer considerable advantages in terms of time, expense, and the sparing of laboratory animals, the study also aimed to dispel some of the controversy and confusion regarding precisely which tests and test batteries are needed to produce a reliable and sensitive assessment of the carcinogenic potential of chemicals in mammals, including humans.

The opening sections explain the purpose and methodology of the study, including criteria used to define an acceptable short-term *in vivo* test, criteria for the selection of test chemicals, and the source and purity of the chemicals, To facilitate evaluation, the fifty test procedures included in the study are divided into six groups: cytogenic studies, liver-specific assays, miscellaneous assays, mouse spot tests, mammalian germ cell studies, and drosophila assays.

The design of the study, which involved numerous tests replicated in a number of different laboratories, allows the remaining sections to offer unique insight into the utility, reproducibility, and reliability as well as the accuracy of each test included in the study. The value of this assessment is further supported by the magnitude of the data base and the considerable experience of the investigators and assessors. The report also constructs a profile, in qualitative terms, of the genotoxic activity of the test chemicals in the whole animal, followed by a second profile of quantitative differences in response according to sex, species, route of exposure, and technical variations.

The report concluded with a detailed assessment of the most effective *in vivo* assays in relation to their performance. The concluding section also identifies assays that are not appropriate for routine testing of chemicals, as well as tests that performed well but are not widely used or available, or that cannot be regarded as practical because of their technical complexity or the length of time required to produce results.

Inorganic Mercury

Environmental Health Criteria, *No. 118, Published by WHO, 1991, 168 pp. (English, with summaries in French and Spanish), ISBN 92 4 157118 7. CHF 20.–/USD 18.00; in developing countries CHF 14.–. Order No 1160118.*

This book evaluates recent research findings useful in assessing the risk to human health posed by the use of inorganic mercury in dental amalgam and in soaps and creams used to lighten the skin. Although such skin-lightening products are now banned throughout the European Economic Community, in North America, and in many African states, the report reveals that mercury-containing soap continues to be manufactured in several European countries, is sold as germicidal soap to the Third World, and is illegally re-imported from African countries to European cities having a substantial black population.

A brief discussion of physical and chemical properties is followed by a review of the most commonly used analytical methods for the quantification of total and inorganic mercury compounds. Sources of environmental discharge and consequent human exposures are considered for both the general population and certain occupations. Data on occupational exposures come from studies conducted in chloralkali plants, mercury mines, thermometer factories, refineries, and dental clinics; high levels of mercury were reported for all these occupational exposures. Concerning exposure of the general population, dental amalgam and food, most notably seafood, are identified as the main sources of exposure. Although exposure of the general population is judged to be low, toxic levels may arise from the mishandling of liquid mercury, mercury dispensed from jars, broken thermometers, fluorescent lamps, and accidental ingestion of mercury batteries, The use of skin-lightening soap and creams results in substantial mercury exposure. Other sections review the mechanisms by which various mercury species are absorbed, in experimental animals and humans, via inhalation, ingestion, through skin, and by axonal transport, noting that roughly 80% of inhaled mercury vapour is retained by the body. The central nervous system is determined to be the critical target organ following mercury vapour exposure.

The most extensive sections review findings from toxicology studies in experimental animals and clinical reports and epidemiological studies in humans. Results from experimental studies show that inorganic mercury can induce autoimmune glomerulonephritis in all species tested, but not in all strains, indicating a genetic predisposition which is in good agreement with clinical findings. Experimental evidence of adverse effects on the menstrual cycle and on fetal development is also supported by human observations of menstrual disturbance, spontaneous abortion, congenital malformations, and low birth weight following maternal exposure to inorganic mercury. Clinical manifestations of mercury poisoning following both acute and long-term occupational exposure are described in full detail.

Concerning the health hazards posed by dental amalgam, no firm conclusions could be reached in the light of severe weaknesses in the design of most epidemiological studies, which have tended to either overestimate or underestimate the daily dose of mercury and the degree of mercury uptake from dental amalgam. The book also included information on reported levels of mercury vapour in dental clinics and the corresponding occupational risk to the dental profession. The concluding sections provide a broad characterization of the risk assessment of exposure to mercury vapour and inorganic mercury compounds.

n-Hexane

Environmental Health Criteria, *No. 122, Published by WHO, 1991, 164 pp. (English, with summaries in French and Spanish), ISBN 92 4 157122 5. CHF 20.-/USD 18.00; Order No 1160122.*

This book evaluates the risks to human health and the environment posed by *n*-hexane, a chemical isolated from natural gas and crude oil and used in food processing to extract vegetable oil from beans, nuts, and seeds. *n*-Hexane is also used as a solvent, a cleaning agent, in the rubber industry, and in the manufacture of pharmaceuticals.

The opening sections review what is known about the behaviour of this highly volatile chemical in the environment and its metabolic fate in experimental animals and in the human body. A review of investigations in experimental animals and *in vitro* test systems concentrated on testicular lesions and neurotoxicity as the principal effects of repeated exposure to *n*-hexane. Studies have also shown that neurotoxicity induced by *n*-hexane is enhanced by co-exposure to methyl ethyl ketone. Methyl isobutyl ketone, and lead acetate; coexposure to toluene decreases the neurotoxic effects of *n*-hexane.

These findings are further supported by observations in humans, which draw upon several reports of peripheral neuropathy in workers exposed to *n*-hexane and in abusers of glues or solvents containing this chemical. The report notes that the majority of occupational cases have occurred in poorly ventilated small industries.

While concluding that *n*-hexane is not likely to present a hazard to either the general population or the environment, the report stresses the need for precautions in the occupational setting, including the use of suitably designed work processes and engineering controls for reducing atmospheric levels below the recommended occupational exposure limits. The book further recommends the use of protective clothing and the ready availability of respiratory protection for use in enclosed spaces and emergencies.

Chlorobenzenes Other than Hexachlorobenzene

Environmental Health Criteria, *No. 128, Published by WHO, 1991, 252 pp. (English, with summaries in French and Spanish), ISBN 92 4 157128 4. CHF 28.-/USD 25.20; in developing countries CHF 19.60. Order No 1160128.*

This book evaluates the risks to human health and the environment posed by exposure to monochlorobenzene, dichlorobenzenes, trichlorobenzenes, tetrachlorobenzenes, and pentachlorobenzene. These chemicals are produced in huge quantities for use as intermediates in the synthesis of pesticides and in the production of a wide range of consumer and commercial products.

The opening section summarizes the chemical properties of these chemicals and describes analytical methods for sampling and determination in various environmental media and in human tissues and fluids. A review of data on sources of environmental exposure notes that release to the environment occurs primarily during manufacture and that incineration of chlorobenzenes may lead to the emission of polychlorinated dibenzo-*p*-dioxins and dibenzoflurans. Data indicate that these chlorobenzenes are moderately persistent in water, air, and sediment, with soils rich in organic matter providing the major environmental sink.

Sections concerned with sources and levels of human exposure conclude that the general population is exposed to the lower chlorinated congeners mainly through inhalation , whereas a greater proportion of the total daily intake of the higher chlorinated compounds is ingested in food; breast-fed babies may receive a higher dose than members of the adult population. Particular concern centres on risks of human exposure arising from the ingestion of contaminated fish and from contaminated indoor air linked to use of these compounds as moth repellents and air fresheners.

Because of weaknesses in available studies, the report was unable to predict the environmental impact of low-level contamination with chlorobenzenes, or to identify the mechanisms by which these compounds might enter the food chain. While ambient concentrations are expected to reach toxic levels only in the case of accidental spills or uncontrolled industrial discharge, the report notes the need to avoid discharge of chlorobenzenes into the aquatic environment, as this can result in the build up of persistent residues in sediment or ground water.

A section concerned with the mechanisms of metabolism and elimination draws upon the results of experimental research and human case reports of poisoning, concluding that these chlorobenzenes are readily absorbed from the gastrointestinal and respiratory tracts, accumulate in fatty tissues, can cross the placenta, and have been detected in fetal brain and liver tissues.

The most extensive section reviews the large number of experimental studies that have evaluated short-term and long-term effects of exposure to these chemicals, including their carcinogenic, teratogenic, and mutagenic potential. Concerning risks to human health, findings from case reports in occupationally exposed populations point to transient effects on the central nervous system, and irritation of the eyes and upper respiratory tract as the principal health effects of exposure.

On the basis of these evaluations, the book concludes that health hazards for the general population arising from exposure to chlorobenzenes other than hexachlorobenzene are minimal. Risks to exposed workers are likewise judged to be minimal, provided good industrial hygiene practices are followed.

1,1,1-Trichloroethane

Environmental Health Criteria, *No. 136, Published by WHO, 1992, 117 pp. (English, with summaries in French and Spanish), ISBN 92 4 157136 5. CHF 17.-/USD 15.30; in developing countries CHF 11.90. Order No 1160136.*

This book evaluates the risks to human health and the environment posed by 1,1,1-trichloroethane, a chlorinated hydrocarbon widely used in the cleaning and degreasing of metal and as a solvent in many industrial and consumer products, including adhesives, spot removers, aerosol cans and cosmetics. 1,1,1-trichloroethane is also used as an intermediate in the production of vinylidene chloride and other chemicals. The abuse of this solvent has resulted in a large number of fatalities.

The opening section describes physical and chemical properties that make this solvent an especially hazardous compound. These include a density that is five times greater than air and the formulation of phosgene, a poisonous gas, as a degradation product. A review of data on the environmental behaviour of 1,1,1-trichloroethane documents its ubiquitous presence in the atmosphere, its rapid transport to the troposphere, its long residence time, its depletion of ozone through the liberation of chlorine atoms, and its contribution to global warming. Because 1,1,1-trichloroethane does not bind to soil

Data indicate that chlorobenzenes are moderately persistent in water, air, and sediment, with soils rich in organic matter providing the major environmental sink. (*FAO photo by I. Bara.*)

particles, leaching into ground water and deep aquifers occurs and persistent contamination has been documented.

The third section evaluates levels detected in the environment in terms of their significance as sources of human exposure. While contamination of the atmosphere is judged to be the most important route of exposure for the general population, the report notes that indoor air may cause considerably higher exposures due to the use of numerous consumer products containing this solvent. Air is also noted to be the main source of exposure at the work place, with workers using 1,1,1-trichloroethane for metal degreasing or drycleaning operations constituting the group at greatest risk.

A review of data on kinetics and metabolism concludes that 1,1,1-trichlorethane is widely distributed in body tissues and crosses the blood-brain and placental barriers. Concerning toxic effects investigated in a large number of animal studies and *in vitro* test systems, the report confirms the significance of exposure via inhalation. 1,1,1-trichloroethane is judged to have low acute toxicity for laboratory animals and to be a moderated skin irritant and a mild eye irritant. While studies have failed to demonstrate a significant mutagenic potential, other investigations have produced evidence of developmental toxicity.

An evaluation of effects on humans draws upon studies of occupationally exposed workers and several cases of fatal exposure following accidents and the intentional abuse of this solvent. Both acute and long-term inhalation exposures are noted to affect the central nervous system, with signs ranging from slight behavioural changes to unconsciousness. Exposure may also cause damage to the heart and liver. A review of accidents at the work place underscores the especially dangerous conditions in poorly ventilated areas and confined spaces, such as tanks and vaults, caused by the compound's greater density than air. The final section evaluates effects on organisms in the field, concluding that environmental contamination is unlikely to pose a significant hazard for environmental organisms. Because of its many other hazards, including its ozone-depleting potential, the report recommends that the release of 1,1,1 -trichloroethane, which occurs mainly during use, be reduced to the greatest extent possible.

2-Nitropropane

Environmental Health Criteria, *No. 138, Published by WHO, 1992, 108 pp. (English, with summaries in French and Spanish), ISBN 92 4 157138 1. CHF 16.–/USD 14.40; in developing countries CHF 11.20. Order No 1160138.*

This book evaluates the risks to human health and the environment posed by 2-nitropropane, an important industrial chemical used as a solvent for printing inks, paints, varnishes, adhesives, and other coatings, such as beverage container linings. 2-Nitropropane is also used in printing inks for flexible food packaging and in food processing, primarily for the separation of oleic acid from polyunsaturated fatty acids.

The report opens with a discussion of the physical and chemical properties that give 2-nitropropane its desirable and occasionally unique characteristics as a solvent. Concerning the behaviour of 2-nitropropane in the environment, a review of the limited data available indicated ready evaporation into the atmosphere, high mobility in the natural environment, and a slow biological conversion to less toxic compounds. An evaluation of environmental levels and human exposure notes that 2-nitropropane has not been detected in water or in outdoor air away from areas of manufacture and use. Although smokers are regularly exposed to low concentrations, exposure of the general population from other sources is judged to be very low. Since 2-nitropropane is manufactured in an enclosed process, the most important occupational exposures are observed to occur after spills and during such operations as the filling of drums, when workers may be exposed to high concentrations.

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2-Nitropropane is used as a solvent for printing inks, paints, varnishes, adhesives and other coatings such as beverage container linings. It is alsoused in printing inks for flexible food packaging and in food processing.

A section devoted to kinetics and metabolism reviews the large number of studies that have investigated mechanisms of absorption, metabolic transformation, and elimination, supporting the conclusion that 2-nitropropane and its metabolites are rapidly eliminated from the body. The most extensive section evaluates data from studies conducted in laboratory mammals and *in vitro* test systems. Studies show moderate acute toxicity for mammals, with considerable variation in the sensitivity of different laboratory animals. Studies conducted in the rat provide clear evidence of destructive changes in the liver, including hepatocellular carcinoma. The report found no conclusive evidence that 2-nitropropane caused cancer in other laboratory species. Data on embryotoxicity, teratogenicity, and reproductive toxicity were judged inadequate.

Concerning effects on humans, the report notes that exposure to high concentrations, which are acutely toxic, is largely or entirely confined to the occupational setting. An evaluation of toxic effects draws upon seven reports of industrial fatalities attributed to inhalation of 2-nitropropane fumes, with death due to acute hepatic failure in all cased. The symptoms of intoxication following non-fatal accidental exposures are also characterized. Although more research on long-term effects is needed, the report notes that available data provide no indication that chronic occupational exposure at concentrations usually encountered in work-place induced hepatic or other neoplasms, or other long-term effects. Because 2-

nitropropane is a potent carcinogen in rats, the report recommends that occupational exposure to this solvent, and its presence in consumer products, be minimized and replaced with a less toxic solvent whenever practical. The report recommends against the use of 2-nitropropane in food processing.

The final section reviews data on toxicity to environmental organisms, concluding that 2-nitropropane does not pose a threat to the environment.

Partially Halogenated Chlorofluorocarbons (Ethane Derivatives)

Environmental Health Criteria, *No. 139, Published by WHO, 1992, 130 pp. (English, with summaries in French and Spanish), ISBN 92 4 157139 X. CHF 18.–/USD 16.20; in developing countries CHF 12.60. Order No 1160139.*

This book evaluates the environmental behaviour, toxicity, and ozone-depleting and global-warming potential of six partially halogenated ethane derivatives selected as candidates to replace the fifteen fully halogenated chlorofluorocarbons that are being phased out in line with the provisions of the Montreal Protocol on Substances that Deplete the Ozone Layer. The compounds considered are 1,1-dichloro-1-fluoroethane (HCFC 141b), 1-chloro-1,1-difluorethane (HCFC 142b), 1,2-dichloro-1,1-difluoroethane (HCFC 132b), 1-chloro-2,2,2-trifluoroethane (HCFC 133a), 1,1-dichloro-2,2,2-trifluoroethane (HCFC 123), and 1-chloro-1,2,2,2-tetrafluoroethane (HCFC 124).

With the exception of HCFC 142b, which is used as an intermediate in the production of vinylidene fluoride, none of these compounds is produced in large quantities. Data on environmental levels and exposure of the general population are extremely limited or, for some compounds, nonexistent. Concerning their potential effect on tropospheric ozone formation, all compounds were judged to have ozone-depleting and global-warming potential considerably lower than those of CFC 11, the fully halogenated chlorofluorocarbon with the highest ozone-depleting and global-warming potential. Atmospheric lifetimes are estimated to range from 1.6 years for HCFC 123 to 19.1 years for HCFC 142b.

Since no data on human exposures are available, the evaluation of toxic effects is confined to a review of findings in laboratory mammals *in vitro* test systems. Although all six compounds have been shown to have how acute toxicity, their toxic effects following repeated exposure differ markedly.

HCFC 132b, an experimental chemical with no commercial application at present, has been shown to cause depression of the central nervous system, signs of hepatotoxicity, and effects on spermatogenesis. Embryotoxicity has also been demonstrated. For HCFC 133a, which is produced in small quantities for use as a chemical intermediate in the manufacture of the anaesthetic halothane, studies of repeated exposure have documented a number of toxic effects, including lung damage, inflammatory changes in the mucosa of the nose, testicular atrophy, and serious effects on reproduction and development. HCFC 133a has also been shown to cause cancer in the rat. Although HCFC 133a and HCFC 132b were judged to pose a low risk to the environment, these compounds could not be recommended as substitutes because of their potential threat to human health.

Studies show that HCFC 142b has a low toxic potential and is therefore not considered to pose a significant risk to human health under non-accidental exposure conditions. Since the toxicity of HCFC 142b is low and the ozone-depleting and global-warming potentials are lower than those of the fully halogenated chlorofluorocarbons, the report concludes that HCFC 142b can be considered as a transient substitute for the chlorofluorocarbons included in the Montreal Protocol.

In view of the paucity of toxicological data on HCFC 141b, HCFC 123, and HCFC 125, no evaluation of their potential effects on human health could be made.

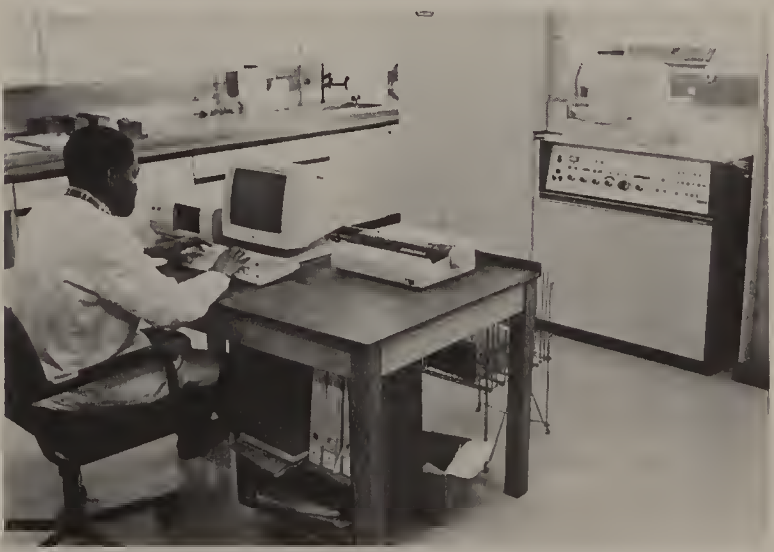
Quality Management for Chemical Safety Testing

Environmental Health Criteria, *No. 141, Published by WHO, 1992, 112 pp. (English, with summaries in French and Spanish), ISBN 92 4 157141 1. CHF 16.–/USD 14.40; in developing countries CHF 11.20. Order No 1160141.*

This book provides a highly detailed guide to the principles and specifics of quality management needed to ensure that studies of chemical safety produce accurate and meaningful results. Focused on the management of both the laboratory and the individual studies it conducts, the book stresses the need to establish and follow formal standard procedures for virtually every laboratory practice that can influence the quality of study results. Details range from a list of the types of records that must be kept, through advice on how to number the pages in standard operating procedures, to a description of the precautions needed to make certain that chemicals used for cleaning or pest control in animals rooms do not interfere with the study.

The objective is to help laboratory managers and staff think through all possible sources of error and plan appropriate measures for their control. For those using laboratory data for chemical risk assessment, the book also serves as an alert to the many variables that can compromise the accuracy of reported data.

The book has three chapters. The first provides a guide to



The objective of Report 141 is to help laboratory managers and staff think through all possible sources of error and plan appropriate measures for their control.

the principles of management and organization required for quality assurance, stressing the importance of making quality assurance an integral part of the entire study process. To this end, readers are given advice on the selection and training of personnel, the use of inspections and audits, the design of facilities, the maintenance and calibration of equipment, and the formulation and use of written standard operating procedures. The remaining sections of the chapter provide detailed advice on the quality management of specific laboratory routines and procedure, moving from the preparation of the study plan, through the characterization of test, control, and reference substances, to the reporting of results and the archiving of data.

The second chapter explains how quality management can be applied to procedures for handling animals at all stages of a toxicity study, from the shipping and receipt of animals to the transfer of tissues and specimens to archives. Key points covered include the proper selection and care of animals, control and storage of feed and bedding, organization of facilities, control of variables such as disease and adverse environmental conditions, methods for identifying each individual animal, and the need to consider the possible impact of chemical agents used for cleaning, pest control, or building maintenance. Procedures that can eliminated bias in the selection of animals are also discussed.

The final chapter provides advice on the quality control of studies designed to measure the presence of chemicals in humans and the environment, and to monitor the extent and effects of exposure.

Data sources in Asian–Oceanic countries

The CODATA Task Group on Data Sources in Asian–Oceanic Countries (CODATA/DSAO) will hold its sixth meeting in Taipei, Taiwan, on 10–12 March 1994. This very active group was established as a Working Group in 1987 and upgraded to a Task Group in 1988. It has produced a *Directory of East Asian Data Sources* and two *Special Reports* on *Presentations*. A *Special Report on Presentations* and an updated *Directory* are in press.

CODATA (Committee on Data for Science and Technology) was established in 1966 by the International Council of Scientific Unions (ICSU). Working on an interdisciplinary basis, CODATA seeks to improve the quality, reliability, processing, management, and accessibility of data of importance to science and technology.

The latest issue of the *CODATA Newsletter* (Vol. 64) has reports on 'Survey of Data Sources in Asian–Oceanic Countries' (see above); the ICSU Federation of Astronomical and Geophysical Data Analysis Services (FAGS) and the various services it provides; and a recent meeting of the CODATA Task Group on Biological Macromolecules.

For further information on CODATA and its publications please contact: Phyllis Glaeser, CODATA Secretariat, 51 Blvd. de Montmorency, 75016 Paris, France. Tel.: +33 (1) 4525 0496/4288 7797. Telex c/o 645544 ICSU F. Fax: +33 (1) 4288 1466. Cable ICSU PARIS 016. E-mail Btgold: 10075:dbi0010. Omnet: CODATA Paris. Internet: codata@paris7.jussieu.fr.

ISO Standards

The following are some of the new international standards announced by the International Organization for Standardization (ISO) in recent issues of *ISO Bulletin*:

September 1993 issue of *ISO Bulletin*

TC 61	**Plastics**
ISO 2578: 1993	Plastics – Determination of time-temperature limits after prolonged exposure to heat
TC 129	**Aluminium ores**
ISO 6139: 1993	Aluminium ores – Experimental determination of the heterogeneity of distribution of a lot
TC 134	**Fertilizers and soil conditioners**
ISO 10084: 1992**	Soil fertilizers – Determination of mineral-acid-soluble sufate content – Gravimetric method
TC 146	**Air quality**
ISO 10397: 1993	Stationary source emissions – Determination of asbestos plant emissions – Method by fibre count measurement
TC 155	**Nickel and nickel alloys**
ISO 11436: 1993	Nickel and nickel alloys – Determination of total boron content – Curcumin molecular absorption spectrometric method

October 1993 issue of *ISO Bulletin*

TC28	**Petroleum products and lubricants**
ISO 4262: 1993	Petroleum products – Determination of carbon residue – Ramsbottom method
ISO 6615: 1993	Petroleum products – Determination of carbon residue – Conradson method.
ISO 10370: 1993	Petroleum products – Determination of carbon residue – Micro method
TC 34	**Agricultural food products**
ISO 6579: 1993	Microbiology – General guidance on methods for the detection of Salmonella
ISO 9930: 1993	Green beans – Storage and refrigerated transport
ISO 10565: 1993	Oilseeds– Simultaneous determination of oil and moisture contents – Method using pulsed nuclear magnetic resonance spectrometry
ISO11289: 1993	Heat-processed foods in hermetically sealed containers – Determination of pH
TC 35	**Paints and varnishes**
ISO 8502-3: 1992**	Preparation of steel substrates before application of paints and related products – Tests for the assessment of surface cleanliness – Part 3: Assessment of dust on steel surfaces prepared for painting (pressure-sensitive tape method)
ISO 10601: 1993	Micaceous iron oxide pigments for paints – Specifications and test methods
TC 44	**Welding and allied processes**
ISO9013: 1992**	Welding and allied processes – Quality classification and dimensional tolerances of thermally cut (oxygen/fuel gas flame) surfaces
TC 45	**Rubber and rubber products**
ISO 8332: 1993	Rubber compounding ingredients – Sulfur – Methods of test
ISO/TR 9474: 1993	Rubber and rubber products – Determination of accuracy and bias of chemical test methods
TC 46	**Information and documentation**
ISO 8777: 1993	Information and documentation – Commands for interactive text searching

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**French version of standard previously published in English only

TC 61	**Plastics**
ISO 75-1: 1993	Plastics – Determination of temperature of deflection under load – Part 1; General test method
ISO 75-2: 1993	Plastics – Determination of temperature of deflection under load – Part 2; Plastics and ebonite
ISO 75-3: 1993	Plastics – Determination of temperature of deflection under load – Part 3: High – strength thermosetting laminates and long-fibre-reinforced plastics
ISO 10964: 1993	Adhesives – Determination of shear behaviour of torque strength of anaerobic adhesives on threaded fasteners
ISO 11003-1: 1993	Adhesives – Determination of shear behaviour of structural bonds – Part 1: Torsion test method using butt-bonded hollow cylinders
ISO 11003-2: 1993	Adhesives – Determination of shear behaviour of structural bonds – Part 2: Thick-adherend tensile-test method.
ISO 11339: 1993	Adhesives – 180 degrees peel test for flexible-to-flexible bonded assemblies (T-peel test)
ISO 11343: 1993	Adhesives – Determination of dynamic resistance to cleavage of high strength adhesive bonds under impact conditions – Wedge impact method
TC 134	**Fertilizers and soil conditioners**
ISO 5308: 1992**	Solid fertilizers – Method of checking the performance of mechanical devices for sampling of product moving in bulk
TC 155	**Nickel and nickel alloys**
ISO 7530-9: 1993	Nickel alloys – Flame atomic absorption spectrometric analysis – Part 9: Determination of vanadium content
ISO 11433: 1993	Nickel alloys – Determination of titanium content – Diantipyrylmethane molecular absorption spectrometric method

Talking the same language

You're saying the same thing (terminologically) but do you mean the same thing (conceptually)?

Many jokes the world over begin: 'When is a … not a …?' and the clue lies usually in a twist of the meaning or a variation in interpretation of the word. But in international communications the same riddles often occur – and are much less easy to solve. Misunderstandings arise when two parties think that they are talking about the same thing, but they are not.

Words are one thing, and translation of words is a – relatively – straight forward business; concepts are another. A concept may well not be understood in the same way from one culture to another. The two may seem to be talking about the same basic idea, but it can't be taken for granted that they are – unless the definition has been standardized. In everyday life, obviously, the problem is unlikely to arise – there is a limit to the need for it – but unclear definitions in the professional area can give rise to delicate situations and confusion.

ISO/DIS 860, *International harmonization of concepts and terms* therefore sets out to refine the linguistic tools at hand so we are all sure we're talking about the same thing when apparently the terms would suggest that we were. This draft International Standard is a revision of ISO/R 860: 1968, and suggests a methodical approach to the international harmonization of concepts, concept systems, definitions, terms and term systems.

Concepts and terms develop differently in individual languages and language communities, depending on historical, geographical, social and economic factors. Differences between parallel concepts on the one hand, and misleading similarities at the term level on the other, cause problems for international communication. Even sometimes apparently basic concepts can be perceived differently because cultural, religious or environmental circumstances are not identical, whence a need to take nothing for granted and to sharpen continuously and keep a permanent watch over the definitions of concepts.

Terminology work is based on concepts because:

1 Differences between concepts do not necessarily become apparent at term level;

2 Similarity at term level in different languages does not necessarily mean that the concepts behind the terms are identical.

Harmonization efforts always begin at the concept level and continue at the term level. Harmonization always involves a comparison and matching of concept languages. It is never the transfer of one concept system as such to another language.

Concepts and terms in International Standards have been developed for international use. They may not, however, be acceptable in an unaltered form in national contexts – a principle that also applies for the official ISO languages at the various national levels. The wording in an English version of an ISO document may not be appropriate for a comparable US or British standard.

This draft International Standard begins with the methods for making a feasibility study, determining whether harmonization is apparently feasible, with an analysis of the subject field, the similarities between concepts and the differences between them. If the chances for such harmonization are good, then it proposes a preliminary analysis of the different concept systems, determining which characteristics the concepts in the different languages have in common and which not.

It is time now to tackle the harmonization procedure proper, and here ISO 10241, *Preparation and layout of international terminology standards,* that defines the way the basic term list is to be compiled and the basic concept system is outlines, holds the key to preparing this stage. In this context, ISO/DIS 860 insists that comparisons should not be limited solely to the official languages, but cover a broader swathe of international possibilities.

The DIS then goes on to look at the concept systems that have also to be compared, to take account of such factors as the *depth* of structuring. Concepts are analysed by taking into account their definitions and not their designations; for the next step, then, the single concepts are matched and compared to choose the most suitable when there are differences between them and to develop a single uniform definition. The harmonized definitions should cover those characteristics that are essential to the intension or connotation of the concept and those that are essential for inclusion in the definition, and they are to be formulated according to ISO 704, *Principles and methods of terminology*, and ISO 10241, mentioned above.

The DIS then moves on to terms and term systems and studies types of correspondence between terms in different languages, those based on the form of terms, on the meaning of terms, and a mixture of both sorts, When it comes to term harmonization, the tradition of using a unified (mostly Greek or Latin) root plays a role in many fields related to chemistry, biology and medicine. In the sciences in general , that the DIS cites as an example of a field where international cooperation on the harmonization of terms is common, the DIS encourages this principle to prevail, suggesting equally a regional approach.

Where there has been no *concept* harmonization previously, however, the DIS discourages any attempt at *term* harmonization, because without the former, the latter can only lead to misunderstandings. Indeed, even in the worthy cause of harmonization, the draft International Standard advised against pushing for the creation of new terms where well-established ones exist, and against pressurizing individual languages to adopt means of term formulation that are alien to their structure. While it emphasizes the advantages of harmonization at an international level, and the virtues of the supranational term, it insists that this should not be at the expense of the national term or create hindrance to communication within a language community,

ISO/DIS 860 completes the ground work for the methodological approach to language unification in the light of the new uses and needs of international communication today.

From ISO Bulletin *Vol. 24, No. 8, pp. 10–11, August 1993.*

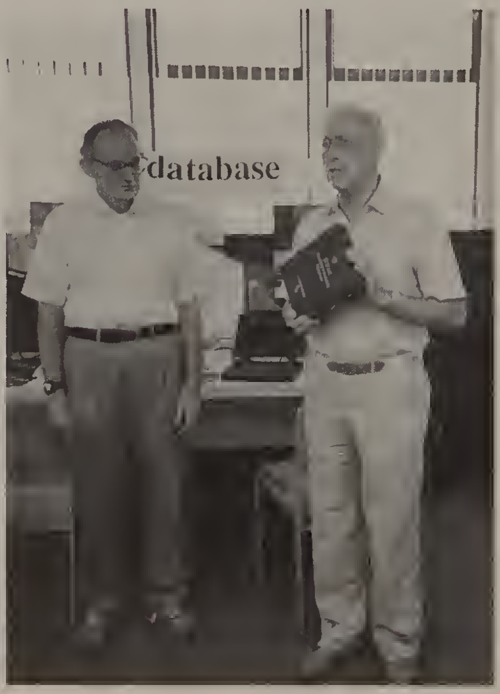
Commission & Committee News

Chemical databases

The meeting of the Committee on Chemical Databases (CCDB) in Lisbon was very productive. The highlights were:

1 The *Standard Molecular Data Project* is moving forward rapidly with the report that Chemical Abstracts Service (CAS) is working on a standard data interchange format for chemical substances and queries (connection table). The first version is to be released in October 1993. The CCDB meeting in London in December will review this and hopefully recommend it for IUPAC approval.

2 The *Stability Constants Database*, from the Commission on Equilibrium Data (V.6), was formally launched in Lisbon with President Bard at the ceremony. To the surprise and delight of CCDB, one copy of the database was actually purchased during the meeting by a delegate from Sweden. The project is now a joint venture between IUPAC, the Royal Society of Chemistry (UK), and Academic Software. Further additions to the database will be supported by the Japanese Ministry of Education.



Allen Bard (left) and Dennis Tuck (Chairman, Commission on Equilibrium Data) launch the Stability Constants Database at Lisbon.

3 The *IUPAC Recommendations Database (IUPACSEARCH)*, jointly developed by CCDB and members of the Committee on Publications, was also launched in Lisbon and copies freely distributed by the Committee on Publications.

4 Agreement was reached concerning the IUPAC sponsored 13th International Conference on Chemical Thermodynamics to be held in Clermont-Ferrand, France, in July 1994. There will be a symposium organized in cooperation with CCDB which will deal with computer applications in handling thermodynamic data.

Stephen Heller

Students' manual on the language of chemistry

The full Committee on the Student-Oriented Nomenclature Book, consisting of Casper Schutte (Chairman), John Bradley, Tom Cvita√, Henri Favre, Stan Głab, Jeff Leigh and Val Metanomski, met to evaluate the almost complete first draft of the students' manual which was written during the year preceding the Lisbon General Assembly. It is clear that the book, although there is still extensive editing to be done, is almost complete.

The committee discussed the various submissions in detail and the agreed changes will now be made by the individual authors. The final editing will probably be done before the end of February 1994. The final document will be submitted to the Interdivisional Committee on Nomenclature and Symbols (IDCNS) before the end of April or May 1994.

The book incorporates several novel features, such as a unified treatment of organic and inorganic systematic nomenclature. In addition, all the main branches of chemistry are also represented in a unified treatment. Maybe the most surprising thing for all of us who participated, is just how much we have learnt from one another, and about the pitfalls of 'loose' formulation and even 'general-established' misconceptions.

Casper Schutte

Quantities, units and symbols in physical chemistry

The second edition of the Green Book – *Quantities, Units and Symbols in Physical Chemistry* – appeared in print in July 1993. The book was discussed by members of the Commission on Physicochemical Symbols, Terminology and Units (I.1) at its meeting in Lisbon. The commission also considered the ongoing project concerning 'Preparation and revision of the Green Book and Abbreviated List and their translation, dissemination and promotion'. The new coordinators of the project are Herbert L. Strauss (University of California) who is Chairman and Martin Quack (ETH, Zürich) who is Secretary.

Discussions in Lisbon also focused on the terminology for one of the most important terms in chemistry: 'amount of substance'. This has been the cause of controversy because of its clumsiness. Numerous other smaller revisions to terminology were also considered.

Joint discussions with the Commissions on Thermodynamics (I.2) and Electrochemistry (I.3) dealt with problems in thermodynamics and electrochemistry. Central terms such as 'electrochemical potential' and the symbol Δ_r for reaction quantities such as $\Delta_r H$ and $\Delta_r G$ were discussed.

Martin Quack

Physical chemistry

At its meetings at the General Assembly in Lisbon, the Physical Chemistry Division Committee together with the Chairmen of Commissions and Divisional Committees discussed the on-going projects and other activities within the division.

Apart from these more-or-less routine topics, the committee dedicated much time to a discussion on future developments. Partly this discussion was a result of the division's initiative to identify a number of 'hot spots' in physical chemistry which deserve attention within the framework of IUPAC. It was also partly triggered by the proposals of the Executive Committee with respect to a restructuring of IUPAC.

A Working Party on 'hot spots' has approached a number of leading persons, that is, authoritative researchers, journal editors, and officers of research foundations, in (physical) chemistry in order to trace modern and novel developments. In personal interviews, these people were questioned about their views on the development of physical chemistry and the possible role IUPAC can play. Topics mentioned for consideration were theoretical and computational chemistry, biophysical chemistry, plasma chemistry, and femtochemistry (ultrafast reactions). In some of these fields the division had already displayed some activity through its Working Party on Theoretical Chemistry, its Steering Committee on Biophysical Chemistry, and its Subcommittee on Plasma Chemistry. In the field of femtochemistry collaboration with the Commission on Chemical Kinetics had induced recently the preparation of a monograph on *Subpicosecond Studies in Chemistry and Photobiology*, with M. A. El-Sayed, Yu. N. Molin and I. Tanaka as editors and a foreseen publication in 1994. With respect to new projects proposed by the commissions, the division committee was happy to observe that the novel review procedure by external referees had created a much better understanding of the scientific value, urgency and usefulness of the proposals and, consequently, a more solid basis for decisions. In this way several new developments could be implemented in the work of the commissions. For other topics the division committee applied for extra places from the pool of 18 titular members which was available for distribution during the Lisbon General Assembly. The committee wanted to strengthen the efforts in theoretical and computational chemistry, scanning probe microscopy, and catalysis with zeolites. An application for three titular members has been granted in the field of theoretical and computational chemistry and a strong start in this direction has been made possible.

University of Lisbon, venue of the IUPAC General Assembly in 1993.

In addition, the division committee recognized the growing importance of biophysical chemistry and the desirability to transform the steering committee in this field into a commission. Also the participation of the Subcommittee on Plasma Chemistry in the divisional activities should be increased. The work of this group has strong links with many chemical applications and an increasing scope within chemistry seems very likely.

Gus Somsen

Thermodynamic data

When the Commission I.2 Subcommittee on Thermodynamic Data met in Lisbon in August 1993, there was much discussion of the Vice-President's report on the work of the subcommittee. This contained a number of statements that were factually incorrect and cast doubt on the suitability of IUPAC to conduct certain projects that were, in fact, proceeding well. Such a report was potentially very damaging, in particular to the work of the Thermodynamics Tables Project Centre in London, where people's jobs were at risk. While the idea of an external review of IUPAC projects was not unwelcome, there was strong feeling that a proper mechanism for rebuttal and correction of critical statements should be set in place.

A second matter for disquiet was the recently-adopted procedure whereby proposals for new projects were externally assessed. This again is basically a sensible procedure, but it is stressed that referees comments must be made available well before general assembly meetings so that the proposers have sufficient time to prepare a reasoned reply. This is particularly important since decisions on new projects can only be made at general assemblies.

The subcommittee noted with satisfaction that:

- The monograph on *Methanol*, Volume 12 in the series *International Thermodyamic Tables of the Fluid State*, had been published earlier in 1993 by Blackwell Scientific Publications.
- Final reports (12 papers) on individual parts of the project on 'Vapour–liquid equilibria in 1-alkanol + n-alkane mixtures' were to appear in a forthcoming special issue of *Fluid Phase Equilibria*.
- The first four papers reporting the results of the project on 'Vapour–liquid critical properties' had been prepared for publication in the *Journal of Chemical and Engineering Data*.
- Agreement had been reached with the Committee on Publications that copyright for the IUPAC publication on the *Heat Capacities of Liquids* would be given to NIST and that IUPAC would receive 10% of the royalties from sales of the publication. Any payment or royalties to authors and/or institutions would be negotiated and arranged by NIST.

John Dymond

Transport properties

Fourteen scientific presentations were made on specific topics to the Subcommittee on Transport Properties of the Commission on Thermodynamics (I.2) when it met in Lisbon in August 1993. The topics related to the three ongoing projects of the subcommittee.

Standard Reference Data for the Transport Properties of Fluids. The work prepared by Prof. H. A. Oye and Dr J. H. Dymond on the standard reference values for the viscosity of hydrocarbons was approved for publication under the auspices of the subcommittee. The uncertainty of the reference values is 0.3%.

A new improved correlation for the thermal conductivity of water, prepared by Prof. C. A. Nieto de Castro, was approved as new and improved recommended reference data.

A new improved correlation for the thermal conductivity of argon, prepared by Dr H. van den Berg, was approved for publication under the auspices of the subcommittee.

Midas Databank of Transport Property data. The work carried out by Prof. K. Stephan and Mr R. Krauss in compiling all recent and unpublished results on transport property measurements is to be continued with emphasis on refrigerants.

Book on Theory and Prediction of Transport Properties. The editors, Prof. C. Nieto de Castro, Dr J. Millat and Dr J. H. Dymond, informed members of the subcommittee that the book will be published by Cambridge University Press. Most of the text is already written, and manuscripts are all to be received by the editors by the end of December 1993 with submission to the publishers in camera-ready form in June 1994.

Round robin project on R134A. The subcommittee noted, with regret, that it had proved impossible to include a project concerned with reconciling the profound differences between the data obtained in different countries within IUPAC. The urgency of the need to resolve this difficulty was not compatible with the time scale required for approval of projects within IUPAC.

Marc J. Assael

Colloid and surface chemistry, including catalysis

The Commission on Colloid and Surface Chemistry, including Catalysis (I.6) met at the 37th IUPAC General Assembly in Lisbon, Portugal, on 5–8 August 1993. Three commission projects have been completed recently and five new projects or feasibility studies were launched at the meeting.

The following projects were completed during the period 1991–93 and sent, or will be sent shortly, to the Interdivisional Committee on Nomenclature and Symbols (IDCNS) and experts:

1 Manual of methods and procedures for catalyst characterization;
2 Thin films, including layers;
3 Recommendations for the characterization of porous solids.

The following new projects or feasibility studies will be undertaken in the period 1993–95:

- Subcommittee on Advanced Materials: Surfaces, Colloid and Catalytic Aspects
    1 Zeolites and porous crystalline solids;
    2 Nomenclature in organic and inorganic membranes;
    3 Recommendations on the characterization of pillared clays.
- Subcommittee on Environmental Protection: Surface, Colloid and Catalytic Aspects
    1 Analytical and environmental technology for the control of pollution;
    2 Scanning-probe microscopy.

It was agreed that the Subcommittee on Environmental Protection would work very closely with the Commission on Environmental Analytical Chemistry (V.9) with the aim of producing a joint report of the work of the two groups by early 1995. A joint meeting of the two groups is planned for Autumn 1994.

It was also agreed to compile a stock of back-copies of Commission I.6 reports covering the last ten years or so. These would be held by the secretary. The aim is to increase their general circulation to the outside world.

The next commission meeting will be held at the 38th General Assembly in Guildford, UK, in August 1995.

Brian Vincent

Atomic weights

Twenty-four members of the Commission on Atomic weights and Isotopic Abundances (II.1), including national representatives and observers, met for 3 days during the 37th IUPAC General Assembly in Lisbon. Three new members were elected to the Commission.

The Commission has revised its table of atomic weights. The atomic weights of four elements have been changed. Based on new determinations of isotopic abundances, the atomic weight of antimony was changed from 121.757(3) to 121.760(1), of iridium from 192.22(3) to 192.217(3), of iron 55.847(3) to 55.845(2), and of titanium from 47.88(3) to 47.867(1). These new data are a significant improvement on the previous values which were based on determinations between 1921 and 1980.

The commission has noted with concern the commercial dissemination of significant quantities of laboratory reagents that have been artificially depleted in ^{6}Li, resulting in labels on containers of reagents with incorrect atomic weight values, which, in fact, may range from 6.94 to 6.99. To make chemists aware of this problem, the commission will add a footnote to the table of atomic weights. Furthermore, an article discussing this problem will be prepared during the next year.

It has come to the attention of the commission that the relative isotopic abundance scales of some laboratories are 'tied' to each through acceptance of isotopic compositions of certain comparison materials. The commission has recommended that only International Atomic Energy Agency primary stable isotope reference materials, such as VSMOW (Vienna Standard Mean Ocean Water), be used to calibrate laboratory reference materials for use in determining relative stable hydrogen, carbon, and oxygen isotopic abundances.

The commission also noted that relative isotope ratio data for oxygen, carbon and hydrogen are often being expressed on non-corresponding scales. The commission has recommended that such isotopic data be expressed only relative to VSMOW (Vienna Standard Mean Ocean Water) or VPDB (Vienna Peedee Belemnite) scales, and that the use of SMOW and PDB be terminated.

Immediately prior to the Lisbon General Assembly, the commission's Subcommittee for Isotopic Abundance Measurements, Working Party on Natural Isotopic Fractionation, Working Party on Non-Terrestrial Isotopic Abundance Data, and Working Party on Statistical Evaluation of Isotopic Abundances met in a hotel in Sintra, Portugal on 3 and 4 August 1993.

The chairman of the Subcommittee for Isotopic Abundance Measurements, Kevin J.R. Rosman from the Curtin University of Technology in Perth, Australia, reported that new isotopic data on eight elements lead the subcommittee to recommend revision of the atomic weights of titanium, iron, antimony, and iridium. Rosman also discussed the variation in atomic weight of lithium, discussed above.

The chairman of the Working Party on Natural Isotopic Fractionation, H. Roy Krouse from The University of Calgary in Alberta, Canada, gave a detailed report on 18 chemical elements that show variation in isotopic composition in naturally occurring terrestrial materials, and thus, variation in their atomic weight. Extensive graphical presentation of these data is planned in one of two reports, both planned for publication by 1995.

Members of the Commission on Atomic Weights and Isotopic Abundances at Lisbon.

The Working Party on Non-Terrestrial Isotopic Abundance Data continued its literature evaluation under the leadership of Masako Shima from the National Science Museum in Tokyo, Japan. Data in this area is expanding at a great rate, and the working party's review of hundreds of articles forms the base of a report that will be published as part of the 'Table of Atomic Weights 1993'.

The chairman of the Working Party on Statistical Evaluation of Isotopic Abundances, Kevin J. R. Rosman from the Curtin University of Technology in Perth, Australia, reported that formal guidelines, as well as new computational procedures, have been developed for use in preparation of the 1995 Table of Isotopic Compositions of the Elements. These guidelines will be presented in the commission's 'Technical Booklet' which is now undergoing revision. This completes the task of this working party.

An archive for Commission II.1 documents has been established at the Chemical Heritage Foundation (CHF) in Philadelphia, PA. Tyler B. Coplen, liaison to CHF, reported that he, H. Steffen Peiser, Thomas Murphy, and Norman N. Greenwood have worked to acquire and organize documents dating from 1827 in this valuable commission asset.

The next meeting of Commission II.1 will be held in Guildford, UK, 5–7 August 1995, during the 38th IUPAC General Assembly.

Tyler B. Coplen

High temperature and solid state chemistry

The Commission on High Temperature and Solid State Chemistry (II.3) meeting at Lisbon heard of the successful completion of the following projects, each of which will result in one or more IUPAC publications:

- The IUPAC Bibliography on the *High Temperature Chemistry and Physics of Materials* has ended its run after publication of some 145 issues. This self-supporting bibliography was prepared by volunteers under the leadership of Dr M. G. Hocking at Imperial College for 37 years, with part 2 being compiled by Prof. L. Brewer of the University of California, Berkeley. A combination of retirements and the increased availability of electronic methods for information storage and retrieval makes it timely to conclude this valuable series.
- The efforts of the subcommittee on 'Terminology and Characterization of Carbon' will result in the publication in *Pure Appl. Chem* of 122 terms in a report entitled 'Recommended terminology for the description of carbon as a solid'.
- The task force on 'High Temperature Mass Spectrometry Cross Sections' will publish a document that will recommend an up-to-date set of ionization cross sections for atoms and list parameters that must be controlled in experimental work for accurate high temperature mass spectrometric results.

- The experimental work of the task force on 'Ionic Conductivity of Fluorite Structured Oxides' will result in four publications, including one to appear in *Pure Appl. Chem*, on 'The conductivity of cubic stabilized zirconia: the results of an IUPAC collaborative study', and two conference presentations.
- A manuscript for *Pure Appl. Chem.* entitled, 'Definitions of terms relating to phase transitions in the solid-state' is now in a final form that has taken account of changes recommended during the IDCNS (Interdivisional Committee on Nomenclature and Symbols) procedures.
- The working party on 'Nomenclature and Terminology of Graphite-Intercalation Compounds' has completed its work, producing a report that has been accepted for publication in *Pure and Appl. Chem* and will later appear as a chapter in Red Book II.
- The long standing project on 'High temperature thermochemical data for the elements' has resulted in a completed database to be distributed on an IBM-PC diskette. However, further investigation of copyright ownership determined that the rights to distribution of the elemental data and of the software used to assess them are held by the publisher who distributed the molecular data of which the data are a subset. Distribution will take place independently of IUPAC.

In addition the commission heard of the status of publications from ongoing projects dealing with the 'Teaching of solid state chemistry', the 'Characterization of SiC powders' and an experimental study on the 'Determination of glass composition by electron probe microanalysis'. The commission also approved and commended the preliminary report of the special working party that had been established by President Allen Bard to provide rapid recommendations for 'Fullerene nomenclature and terminology'. In view of the widespread interest, and extensive activity, in this new area of chemistry the report will be given accelerated treatment by IDCNS for publication in *Pure Appl. Chem.*

Two new projects were initiated that grew out of the 1992 Rome workshop on ceramics held by the commission in coordination with IUPAC's Chemistry and Advanced Materials Programme, one on 'High temperature chemistry in ceramics processing' and the other on 'Surface analysis of ceramics'.

Finally, the commission enthusiastically endorsed plans for the IUPAC sponsored 8th International Conference on High Temperature Materials Chemistry to be held in Vienna, 5–8 April 1994.

The next meeting of Commission II.3 will be held in Vienna, Austria, on 11–12 April 1994, following the conference.

Gerd M. Rosenblatt

Photochemistry

The Commission on Photochemistry (III.3) has strong links with the community of practising photochemists, especially through the European, Japanese and US photochemical societies. Commission members are, or have been, officers of these societies, and the society newsletters are used as channels to make the commission's work known and to solicit comment on draft material.

The normal pattern of the commission's operation of its projects is for one or two of the titular members to organize a working group that draws in international expertise on a broad basis. Sometimes the project is outside the personal specialist areas of commission members, in which case the titular member acts as 'host' and the working group is convened by an expert who may not be a commission member. The commission anticipates that more of its projects may operate on this basis in future, as issues such as general terminology and data presentation are succeeded by projects in applied areas such as water treatment or photostability testing.

Methods for the analysis of transient absorption kinetic data are the subject of one current project. A wide variety of programmes are in use for such analysis, many developed by individual experts or teams. We hope to identify and collate guidelines for the use of these and similar programmes, both for data acquisition and data analysis.

Protocols for making measurements and reporting results on the heterogeneous photocatalysed degradation of pollutants in aqueous solution form one part of a new 'water treatment' project. This approved project marks the shift of emphasis already mentioned, to areas of the subject which have relevance for their practical application as well as intrinsic interest. Two potential projects for the future show the same trend – methods and standards for the photostability testing of drugs, and terminology and practice in the chemical conversion of solar energy. Both of these will be tested for feasibility prior to the commission's next meeting which will be held in Prague, Czech Republic, on 25–30 July 1994.

John Coyle

Microchemical techniques and trace analysis

The Commission on Microchemical Techniques and Trace Analysis (V.2) met at the 1993 General Assembly in Lisbon. In addition, the Working Group on Organic Trace Analysis, the Working Group on Speciation of Trace Elements, and the Working Group on Quality Assurance also held meetings. Good progress was made on a number of Commission projects which were reviewed at this meeting.

The Working Group on Speciation of Trace Elements has taken a critical look at its programme and has decided to take on a new area involving speciation of essential elements as a

Commission V.2 at Lisbon.

complement to the work which has been done on toxic elements. There is also an effort to form a group to work on definitions of speciation and related terms.

One of the important parts of the programme of the Working Group on Organic Trace Analysis is trace analyses relating to the environment, and the commission continues its contribution in this area through the organic group and also the Working Group on Quality Assurance.

The commission has refocused its work in the analytically important area of surface analysis and established an official Working Group on Surface Analysis at the General Assembly. One of the new projects of this group is a critical review of scanning probe microscopies, an area recognized by IUPAC as needing attention.

The next meeting of the commission will be held in Barcelona, Spain, on 6–7 May 1994.

David Westmoreland

Chromatography and other analytical separations

The period leading up to the Lisbon General Assembly was very uncertain and a little gloomy for the Limited Lifetime Commission (LLTC) on Chromatography and Other Analytical Separations as, although it was known that the commission would cease after the Lisbon meeting, there was no certainty that it would be replaced or that its activities would continue.

However, commission chairman Peter Uden and secretary Roger M. Smith were able to open the proceedings of the commission with the good news that the Analytical Chemistry Division had recommended to Bureau that a new permanent commission should be created by rearrangement of titular members within the allocation of the division. This decision was gratefully received as it recognized the important and central position of separation methods including chromatography as one of the corner stones of analytical chemistry. This proposal was subsequently accepted by Bureau and the LLTC will now pass on its projects to the Commission on Separation Methods in Analytical Chemistry (V.3). Aurel Marton will become the chairman of the new commission and Smith will continue in the role of secretary.

The commission was then able to proceed with the consideration of the work that had been undertaken over the four year life span of the LLTC. The most important project had been the completion and publication of the 'Nomenclature for chromatography' prepared by Leslie Ettre [*Pure Appl. Chem.* **65**, 819–872 (1993)]. This comprehensive paper had been in preparation for some 12 years and was seriously needed to update and revise the existing often outdated recommendations in the Orange Book (*Compendium on Analytical Nomenclature*). It covers all the main areas of chromatography and will form the backbone of the work of the commission for many years to come.

The commission also learnt that the first stage of updating had already occurred with the acceptance for publication of the 'Nomenclature for supercritical fluid chromatography and extraction' prepared by Smith. Two further papers had also been completed and had been submitted for publication in *Pure Appl. Chem.* – the 'Nomenclature for analytical pyrolysis' prepared by Uden, and the 'Nomenclature for liquid–liquid distribution (solvent extraction)' whose final form was prepared by Mick Leonard.

Gas–liquid chromatography in a chemical works laboratory. The LLTC on Chromatography and Other Analytical Separations published its 'Nomenclature for chromatography' in 1993. The paper cover all the main areas of chromatography. (*PHOTO RTZ Ltd.*)

The commission then went on to discuss a programme of work that will be passed to the new commission. Two major areas will be the continuation of active projects on stationary phases and on mobile phases for liquid chromatography. The first of these will cover the terminology to be used and will be followed by a paper to be prepared by Marton on recommendations for the characterization of ion exchange stationary phases. Proposals were also accepted for work on the nomenclature of non-linear chromatography, conditions frequently seen in real separations. A new project will be the nomenclature of chiral chromatography which is becoming an important area as synthetic and pharmaceutical chemists try to separate and understand the differing activities and properties of the enantiomers of drug compounds.

The new commission will also extend studies into detection in chromatography including coupled and hyphenated systems and this is likely to lead to close collaboration with other commissions in the Analytical Chemistry Division.

The LLTC members ended the meeting by expressing thanks to Peter Uden who was retiring from the Union after 12 years service in the division. He had worked hard for the establishment of a permanent Commission on Separation Methods in Analytical Chemistry and was pleased that his efforts had at last been fruitful.

The next meeting of Commission V.3 is expected to be held in late July or August 1994 in Europe.

Roger M. Smith

Spectrochemical and other optical procedures of analysis

The departure of Allan Ure as Secretary of the Commission on Spectrochemical and other Optical Procedures for Analysis (V.4) sees the last of the atomic spectroscopists who have in recent years presented IUPAC nomenclature documents in the field of atomic and X-ray spectrometry.

An index of recommended terms from Parts I–XIII of the series of reports on 'Nomenclature, Symbols, Units and their Usage in Spectrochemical Analysis' is in preparation and will be published hopefully in 1994. While the commission is still dealing with the nomenclature for methods of spectrochemical analysis, the emphasis is now mainly on molecular spectrometry for chemical analysis and on inorganic mass spectrometry.

New areas of attention for which new projects are being initiated include spectrochemical analysis methods used in environmental and bioanalytical areas. In these new areas, projects will not be confined to nomenclature but to the identification, recommendation, and critical assessment of optical procedures.

The commission will hold a mini-meeting is Essen, Germany, on 17–18 September 1994.

David S. Moore

Actinide/lanthanide and transactinide elements chemistry

When it met at the General Assembly in Lisbon, the Commission on Radiochemistry and Nuclear Techniques (V.7) proposed three new projects on actinide/lanthanide and transactinide elements chemistry.

The commission has already published a review paper on 'Actinide migration in groundwaters' [*Pure Appl. Chem.* **65**, 1081–1102 (1993)]. Also in print in *Pure Appl. Chem.* is a review on 'Determination of very low levels of radioactivity'. The following papers are under review or in revision after review by the Analytical Chemistry Division: 'Isotopic and nuclear analytical techniques in biological systems'; 'Part IX – Neutron activation analysis'; 'Part X – Isotopic dilution analysis'; 'Applications of accelerator mass-spectrometry'; 'Nomenclature for nuclear and radioanalytical chemistry'; and 'Westcott g-factor for neutron activation analysis'.

Two other projects were finished as drafts and are being currently reviewed by Commission V.7: 'Speciation of trace elements in the environment, Parts 1–3' and 'Spontaneous fission half-lives'. With one exception (the cancelled project on the 'Use of radiation in industry'), all projects have progressed well within the initial time frame.

Three new projects which have been reviewed according to the new IUPAC policy by external experts were submitted to the Analytical Chemistry Division, namely: 'Critical evaluation of the chemical properties of the transactinide elements'. 'Actinides(III)/lanthanides(III) separations in relation to nuclear waste management' and 'Critical evaluation of resonance integrals for activation analysis'.

Two additional new projects were proposed to Commission V.7: 'Low activation materials for fusion technology' and 'Liquid scintillation spectrometry for α-emitters'. These will be externally reviewed by non-IUPAC experts. Feasibility studies for three further projects were initiated after critical evaluation by Commission V.7.

The next commission meeting will be held in Kailua-Kona, Hawaii, on 9 April 1994 before the 3rd International Conference on Methods and Applications of Radioanalytical Methods, on10–16 April 1994. Contact: Prof. Roy Filby, Chairman, Department of Chemistry, Washington State University, Pullman, WA 99164-4630, USA.

H. R. von Gunten

Not the Olympics – IBS 2000

It was not the Olympics – but we had four applications for hosting the 11th IBS (International Biotechnology Symposium) to be held in the year 2000. After Israel and Austria withdrew their applications before the meeting of the Commission on Biotechnology (VI.2) in Lisbon, it was Berlin, Germany *versus* Basel, Switzerland.

The presentations from the two competing cities stimulated intensive deliberations. It was clear that both cities could host an exciting meeting in a stimulating atmosphere. In the end it was Berlin that won the opportunity to be host.

Whilst we were in the midst of discussing meetings, we decided to put a new twist on our project on 'Biotechnology and the environment' by planning a symposium to be held on a boat on the Volga River in Russia next summer. This fits in nicely with our idea of a feasibility study to help Eastern European countries get their biotechnology into a competitive position by free market standards.

A major focus of our discussion of projects was on the 'Glossary for chemists of terms used in biotechnology' which was published in *Pure Appl. Chem.* **64**, 143 (1992) in English. Translations into six more languages are now available or are in progress, so we are looking for a publisher for a multilingual edition. The 'Selection of terms, symbols and units related to microbial processes' has also been published since the Hamburg General Assembly in 1991 [*Pure Appl. Chem.* **64**, 1047 (1992)]. Our on-going project 'Interrelations of chemistry and biotechnology' was also published in 1992 [*Pure Appl. Chem.* **64**, 169 (1992)]. There will be more to come in this series so make sure you keep an eye on the pages of *Pure Appl. Chem.*

The next meeting of Commission VI.2 will be held in conjunction with the International Symposium on Biotechnology and the Environment planned for June 1994 in Moscow, Russia.

Heinz K. Kölbl

An International Symposium on Biotechnology and the Environment is planned for the Moscow area in June 1994.

Oils, fats and derivatives

The 46th meeting of the Commission on Oils, Fats and Derivatives (VI.3) was held at the Lisbon General Assembly. It was attended by 20 participants from 16 countries. Paul Kolodziejczyk, the new national representative for Canada was especially welcomed.

In his chairman's report, Albrecht Dieffenbacher remarked that he had observed many transitions in the world around us as well as within IUPAC and the commission. Dieffenbacher reported on the latest collaborative study on the 'Determination of *trans* fatty acids by capillary gas chromatography'. A report for publication in *Pure Appl. Chem.* will be written after which the project will be closed.

Marshall Pike will write a final report on 'The detection of cross-contamination with volatile industrial chemicals of edible oils transported in bulk'. After publication in *Pure Appl. Chem.* this project will also be closed. Pike regretted that no collaborative study had been carried out on the determination of residual chlorinated hydrocarbons. The coordinator will organize a collaborative test in the following months.

Carmen Dobarganes Garcia reported on a successful feasibility study on 'The detection of thermally treated oils'. Garcia's proposals will lead to two new projects: 'Detection of thermally treated oils in cold pressed oils' and 'Determination of oxidized triglycerides using high performance size exclusion chromatography (HPSEC)'.

Patric Dysseler and François Mordret reported on progress with their project on 'The determination of cadmium by atomic absorption spectrometry'. The feasibility study resulted in a new method which will be studied in a collaborative study over the next two years.

No progress could be reported on 'The determination of the unsaponifiable index' and on 'The calculation of the fatty acid composition in m/m % from gas chromatography data' due to the absence of the coordinator Karsten Stig-Andersen.

John Holm reported on the feasibility study on 'The minimization of the acid value determination', the results of which were considered promising. A final collaborative study with more participants will be organized for this new project before the next meeting of Commission VI.2.

Gerhard Zwerenz had to resign as coordinator of the project on 'Replacement of toxic and/or hazardous chemicals in the standard methods'. His replacement is David Berner.

At the request of Marshall Pike, the 'Determination of phosphorus in oils with a spectrophotometric method' will be studied. Pike will be the coordinator. Pike will also participate, at the request of the division president, in work on a pollution project of another commission in the division.

Joyce Beare-Rogers announced a draft of the *Lexicon for lipid nutrition* prepared by a joint Commission VI.3 and IUNS (International Union of Nutritional Sciences) working group. The draft is under review in both organizations.

Albrecht Dieffenbacher, who completes his term of office at the end of 1993, will become a member of the Applied Chemistry Division Committee. Dieffenbacher wished his successor, the new chairman Patric Dyseeler, strength and luck in his new function.

Commission VI.2 will next meet in Bruges, Belgium, on 7–10 September 1994.

Pim Hendrikse

A cement factory pours forth smoke and dust over the surrounding sorghum fields in Senegal. The Commission on Atmospheric Chemistry has initiated projects on the impact of air pollution in developing countries. (*FAO photo by H. Null.*)

Atmospheric chemistry

A number of ongoing projects were concluded successfully during the Lisbon meeting of the Commission on Atmospheric Chemistry (VI.4).

Warneck prepared and distributed to commission members a final draft paper on 'Evaluation and recommendation of units for use in atmospheric chemistry'. Tang has started a series of articles on local environmental problems. Three articles covering Germany, Japan and the Netherlands were sent to the editor of *Chem. Intl.*. Two other articles from India and Turkey are in preparation. Brown has reported on 'Use of passive samplers for monitoring of ambient air' in *Pure Appl. Chem.* Slanina and Akimoto have edited the proceedings of the Workshop on the Assessment of Future Atmospheric Concentrations of Methane and these are now ready for publication in *Pure Appl. Chem.*

Akimoto's report on 'Major concerns and research needs for our understanding of the chemistry of the atmosphere' is ready for publication and has been the basis for formulating future activities of Commission VI.4 together with other commissions of the Division of Applied Chemistry.

The commission has come to the conclusion that existing international organizations involved with environmental research have not concerned themselves with one of the most pressing problems in developing countries: assessment of the local impact of air pollution. Accordingly, the commission has decided to organize a Workshop on Local Air Pollution in Rapidly Developing Countries. This will be held in China in 1994. The aim is to exchange knowledge and expertise in this area between experts who studied these problems in Europe and the USA about 10 years ago, and scientists who are confronted with the same type of problems in developing countries at present.

A joint project of Commission VI.4 and the Commission on Water Chemistry (VI.6) on 'Assessment of the influence of atmospheric deposition of water quality' is also concerned with this problem of local impact of air pollution.

A number of other future activities were outlined at the Lisbon meeting (see over):

Commission VI.4 members at Lisbon.

- Tropospheric ozone as a greenhouse gas.
- IR cross sections of climate related trace gases.
- Radiation balance of atmospheric aerosols.
- Compilation and critical assessment of rate coefficients of aqueous phase reactions relevant to atmospheric chemistry.
- Trends of aerosol composition and concentration based on existing network data (in view of the large impact climatic change).
- Assessment of dry deposition on different scales.
- Definitions and units for Henry's law coefficients.

The commission looks forward to a very active period in the near future.

J. Slanina and P. Warneck

Water and soil chemistry

Three major items were discussed at the meeting of the Commission on Water Chemistry (VI.6) at Lisbon:

- the future of the commission; particularly the extension of commission activities to include aspects of soil chemistry;
- new composition of the commission;
- organizational aspects of project work.

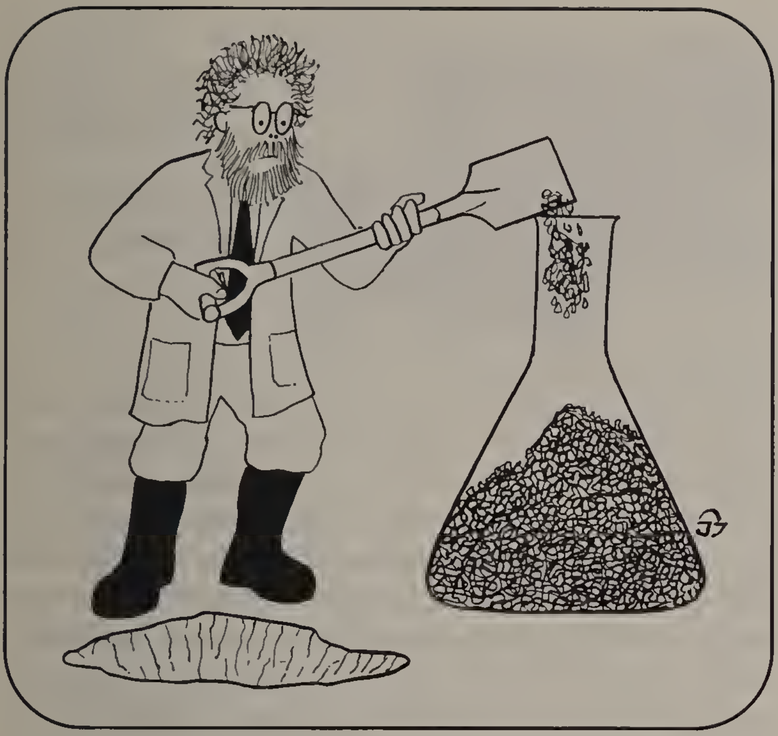
A joint meeting with the Commission on Atmospheric Chemistry (VI.4) was also organized to discuss progress of joint projects.

The major decision taken in Lisbon was to extend the work of the commission to soil chemistry as a new area of interest. Closer working with Commission VI.4 was also agreed to enable consideration of environmental problems. Two new titular members were assigned, and it was also agreed that new associate members, capable of providing a significant input into the work of the commission will be appointed.

A new working structure was also agreed. In future the major task of the titular members will be to manage current projects, and to initiate new projects and feasibility studies. Once new projects are approved a titular member will be appointed as project manager and one or more associate members considered to have the expertise needed, will be asked to carry out the project jointly with the remaining members of the commission.

Progress of the commission's current projects was reviewed. Two projects were completed successfully this year. Two other projects ('*In-situ* treatment of groundwater' and 'Immunoassays for water monitoring') will be completed in 1994, whereas the project on 'The distribution of HCFC oxida-

The Commission on Water Chemistry has decided to extend its activities to include aspects of soil chemistry. One of the commission's new projects concerns 'The importance of natural organic material for environmental processes in waters and soils'. (*Photo: UNESCO/Dominique Roger*)



tion products in the hydrosphere' will need to be taken up by a new project leader. In 1994, progress of this project will be reviewed again.

ICSU (International Council of Scientific Unions) funding was obtained to organize a workshop on 'Quantitative structure biodegradability relationships (QSBRs)' in Autumn 1994. A paper has been prepared reviewing the 'state of the art' and identifying the limitations of present QSBRs that need to be addressed at the workshop.

New projects on 'The quality of chemical data in databases' (jointly with the Commission on Atmospheric Chemistry), 'Code of practice for reporting analytical data for environmental samples' (jointly with the Commission on Microchemical Techniques and Trace Analysis) and 'The importance of natural organic material for environmental processes in waters and soils' were initiated. Seven feasibility studies were proposed. The impact of deposition of nutrients on ground water quality will be investigated jointly with the Commission on Atmospheric Chemistry.

In order to prepare for the inclusion of soil chemistry and to discuss possible new projects in this field, a meeting with new titular members will be organized in November 1993.

The next meeting of Commission VI.6 will be held on 9 November 1993 at the Water Research Centre, Medmenham, UK.

Willie Peijnenberg

Toxicology

During the Lisbon General Assembly, the Commission on Toxicology (VII.4) made use of intensive interdivisional discussions to define new and important areas of activity and cooperation.

The highly rated 'Glossary of terms used in toxicology' was published in the September 1993 issue of *Pure Appl. Chem.* Chairperson of ComTox Rita Cornelis thanked John Duffus and his working party for their efforts. The draft of the glossary had already become a 'best-seller' and the commission was delighted to learn that WHO (World Health Organization) and IPCS (International Programme on Chemical Safety) expressed great interest in its further use. The commission sees the glossary as basic teaching material to provide chemists with defined and accepted terms usually not familiar to them.

The need to include toxicology in the curriculum of tertiary education was uniformly accepted following discussions with the Committee on Teaching of Chemistry (CTC). John Duffus and Howard Worth (CTC) have prepared a proposal for a joint project on 'Materials for training and teaching the basic principles of toxicology to chemists'. These will include extended descriptions of the most relevant terms, the glossary itself and other information. Ram S. Lamba suggested that a symposium on toxicology for chemistry teachers might help introduce the subject into the curriculum. In response, Birger Heinzow offered to organize a symposium on 'Chemical safety and risk assessment' during the 13th International Conference on Chemical Education to be held in Puerto Rico, August 1994.

The commission's interest in the toxicology of trace elements has continued. Douglas Templeton has prepared a paper on 'Nickel in body fluids' which is now undergoing the review process within IUPAC. At Lisbon the project on 'Guidelines for sample collection of trace elements' by Rita Cornelis was finalized and will be submitted late in 1993. This will be the last of the trace element papers. The commission has reacted to the recommendation of the biennial critical assessment by reorientating to more general topics.

Proposals for a new project on guidelines for 'Sampling of volatile organic chemicals (also known as VOCs) for biomonitoring' opens up new areas in the field of toxicology. Human beings are exposed to these ubiquitous VOCs at home and elsewhere in the environment. Such guidelines are urgently needed.

The Commission on Toxicology and the Committee on Teaching of Chemistry discussed toxicology in chemistry curricula at the tertiary level.

Jytte Molin Christensen proposed two projects dealing with important statistical aspects related to biomonitoring of toxic or physiological compounds: 'Calculation of reference values' and 'Decision rules for exposure assessment'. These projects have implications generally and also for other areas of environmental analytical chemistry.

Following discussions with the Commission on Microchemical Techniques and Trace Analysis on speciation, it was agreed that a workshop for 1994 on terms used for speciation in trace analysis should be planned.

Birger Heinzow

Medicinal chemistry

The IUPAC Medicinal Chemistry Section met at the Lisbon General Assembly on 5th August 1993. The activities of the various working parties in the Section were reviewed.

The objective of the Medicinal Chemistry Curriculum Working Party, chaired by Prof. C. R. Ganellin, is to examine how best to structure a medicinal chemistry curriculum with regard to subject matter, sequence and emphasis, recognizing that the pharmaceutical industry is by far the largest employer of medicinal chemists.

Ganellin reported that he presented a paper titled 'Views from industry on the medicinal chemistry curriculum: answers to a questionnaire' at a symposium in The Netherlands on 'Teaching Medicinal Chemistry' held on 28th May 1993. The paper described the results from the first round of some 60 completed questionnaires received from pharmaceutical companies. A second round of questionnaires to American (primarily) and European pharmaceutical companies had an 80% response rate and this additional data is now being analysed. Both overall and individual country viewpoints will be summarized. These results should prove useful in setting up additional new courses on medicinal chemistry in interested countries similar to those given in Canterbury, UK, and Drew University, Madison, New Jersey, USA. The plans are to publish the questionnaire data and resulting recommendations – probably in *Pure and Applied Chemistry*.

The purpose of the Working Party on Terminology in Medicinal Chemistry, chaired by Prof. C. G. Wermuth, is to identify terms used in medicinal chemistry whose usage and meaning are not uniform in the discipline, and to provide clear and concise definitions for these terms. Wermuth reported that the glossary is nearly completed and a draft will be sent out shortly for final comment. It is expected to contain up to 100 terms. Publication in *Pure Appl. Chem.* is planned.

The Working Part on Guidelines for Natural Product Collaborations, chaired by Prof. L. A. Mitscher, aims to formulate, for information purposes, a set of guidelines for natural product collaborations between scientists and companies for new medicinal agent lead identification. These guidelines could provide a model for typical agreement frameworks and give the inexperienced scientist a useful reference point from which to proceed in setting up agreements covering desired collaborations.

In the absence of the chairman, Section President Prof. J. G. Topliss reported that this project had received favourable comments from outside and that Mitscher had completed the formation of the working party. Its activities were now beginning.

The Medicinal Chemistry Section is developing a glossary of terms used in computational drug design.

The objective of the Working Party on a Computational Drug Design Glossary of Terms for the Medicinal Chemistry, chaired by Dr C. A. G. Haasnoot, is to develop a glossary of terms used in computational drug design for the medicinal chemist for easy reference purposes recognizing that many medicinal chemists lack significant formal training in this field. Topliss reported that this project had been sent for outside review and had been endorsed. Recruitment of members for the working party is well under way.

The Vice-Presidential Critical Assessment was discussed by the Section in some depth particularly with regard to the activities of the Section. Responses to Vice-President Staab's comments were sent by Topliss and Busse before the Lisbon meeting.

Dr Koga reported on progress with organization activities for the Asian Federation for Medicinal Chemistry (AFMC) International Medicinal Chemistry Symposium to be held in Tokyo in September 1995. He handed out copies of the first circular for the meeting. He asked for comments and recommendations from Section members. Ways to effectively distribute the circular were discussed.

'Topliss asked Section members to think about and suggest new ideas for projects and to solicit suggestions from colleagues. In addition, he will contact individuals at higher managerial levels in US pharmaceutical companies to ask what projects are of interest there.

The next meeting of the Medicinal Chemistry Section will be held on Sunday, 13th March 1994 in San Diego, California, in conjunction with the American Chemical Society National Meeting.

J. G. Topliss

Appointment

Dr R. Potenzone Jr. (Chemical Abstracts Service, Columbus, USA) has been appointed Secretary of the Committee on Chemical Databases (CCDB) for the biennium 1994–95. His full address details are given below.

We regret to record the deaths of

Prof. O. Hoffmann-Ostenhof, Austria (14 October 1992) – IUB–IUPAC Commission on Biochemical Nomenclature (1959–76), Interdivisional Committee on Nomenclature and Symbols (1966–76).

Prof. H. M. N. H. Irving, UK (20 June 1993) – Interdivisional Committee on Nomenclature and Symbols (1969–79), Commission on Analytical Nomenclature (1963–85), Commission on Equilibrium Data (1955–65).

Dr A.O. Vesala, Finland (30 April 1993) – Commission on Solubility Data (1979–87).

Names and Addresses

Full details (names, addresses, telephone/telex/fax numbers, and e-mail) of officers of IUPAC bodies were published in *Chem. Intl.* **15**, 215–227 (1993). The IUPAC Secretariat has since been notified of the following changes:

Drs J. BOUMA (Secretary, Committee on Teaching of Chemistry). Buys Ballotweg 92, 3731 VL De Bilt, The Netherlands, Tel./Fax: +31 (3) 204496.

Dr A. J. DOBBS (Chairman, Commission on Water Chemistry). WRc plc, Henley Road, Medmenham, Marlow, Bucks SL7 2HD, UK. Tel.: +44 (491) 571531. Fax: +44 (491) 579094. Telex: 449541.

Prof. J. A. KERR (Secretary, Commission on Chemical Kinetics). Tel.: +41 (1) 823 5462. Fax: +41 (1) 823 5471.

Dr. A. MARTON (Chairman, Commission on Separation Methods in Analytical Chemistry). Tel.: +36 (88) 422022. Fax: +36 (88) 426016.

Prof. I. MILLS (Chairman, Interdivisional Committee on Nomenclature and Symbols). E-mail: i.m.mills@reading.ac.uk

Dr D. S. MOORE (Secretary, Commission on Spectrochemical and Other Optical Procedures for Analysis). Am Langensiepen 11, D-45259 Essen, Heisingen, Federal Republic of Germany. Tel.: +49 (201) 461028 or +49 (201) 183 3057. Fax: +49 (201) 183 3228. Internet: CPH070@vm.hzr.uni-essen.de

Dr M. PARKANY (Secretary, Analytical Chemistry Division). Tel.: +41 (22) 749 0111. E-mail [X400]: C=CH; ADMD=ARCOM; PRMD=ISO; O=ISOCS; S=PARKANY E-mail [Internet]: parkany@isocs.iso.ch

Dr R. POTENZONE, JR. (Secretary, Committee on Chemical Databases) Chemical Abstracts Service, New Products Development, Department 07, PO Box 3012, 2540 Olentangy River Road, Columbus, Ohio 43210, USA. Tel.: +1 (614) 447 3779. Fax: +1 (614) 447 3697. E-mail: rxp07@cas.com.

Dr M. SALOMON (Chairman, Commission on Solubility Data). Department of the Army, US Army EPSD (ARL), Mail Stop AMSRL-EP-PB, Fort Monmouth, New Jersey 07703-5601, USA.

Prof. P. S. STEYN (President, Applied Chemistry Division). Department of Chemistry, Private Bag X6001, University of Potchefstroom for Christian Higher Education, Potchefstroom 2520, Republic of South Africa. Tel.: +27 (148) 99 2340. Fax: +27 (148) 99 2799. E-Mail: chemjpf@puknet.puk.ac.za

Address of IUPAC Secretariat

Please use the following address for all communications directed to the IUPAC Affiliate Affairs Secretary. If your are submitting a letter for publication in *Chemistry International* (*CI*), please indicate that the letter is 'Submitted for publication in *CI*.'

Affiliate Affairs Secretary, IUPAC Secretariat, Bank Court Chambers, 2–3 Pound Way, Templars Square
Cowley, Oxford OX4 3YF, UK.
Tel: +44 (865) 747744; Fax: +44 (865) 747510
E-mail: iupac@vax.oxford.ac.uk

Information for affiliates

IUPAC publications

Affiliates are entitled to a 25% reduction and in some cases a 40% reduction on the cost of IUPAC publications except the scientific journal *Pure and Applied Chemistry*. A leaflet detailing IUPAC books currently available from Blackwell Scientific Publications has recently been distributed by the publishers to all *CI* readers. Further copies may be obtained from the IUPAC Secretariat.

How to contact commissions

IUPAC affiliates are entitled to communicate directly on scientific matters with the officers of IUPAC commissions. A full list of names and addresses of all commission officers for 1994–95 was published in the November 1994 issue of *CI*.

IUPAC-sponsored conferences

If you are interested in attending a conference please apply directly to the conference organizers for the conference circulars and registration forms. An updated list of names and addresses of the organizers of all future IUPAC sponsored conferences is given in the 'Conference Calendar' published in each issue of *CI*.

Affiliate reduction of conference registration fees

It is a condition of IUPAC sponsorship of a conference that IUPAC affiliates are entitled to a 10% reduction or 'own members' rate on the registration fee for scientific participants. This concession is usually, but not always, announced in the conference circulars and indicated on the registration form.

To receive this reduction an affiliate must declare on the conference registration form that (s)he is an affiliate. Alternatively the affiliate should apply in writing to the conference organizer for this reduction stating that (s)he is an affiliate. Conference organizers may check with the IUPAC Secretariat that applicants for this reduction are currently registered as affiliates.

If an application for this reduction is refused, an affiliate should immediately notify the Affiliate Affairs Secretary and, if possible, forward copies of documentary evidence of this refusal.

IUPAC poster

Copies of an IUPAC poster are available **free of charge** to affiliates and members of IUPAC's commissions and committees. The poster is printed in maroon and black on a white background and is approximately 42 ∞ 59 cm in size.

IUPAC welcomes any publicity you can give to its activities. If you would like to display one or more copies of the poster in your department or elsewhere please write to the Affiliate Affairs Secretary stating your name and address and how many copies of the poster you wish to receive.

Conferences

Photochemistry
Prague, Czech Republic
17–22 July 1994

The 15th IUPAC sponsored International Symposium on Photochemistry will be organized by the Prague Institute of Chemical Technology, Department of Organic Chemistry, on 17–22 July 1994. The venue is the capital city of the Czech Republic (formerly of Czechoslovakia) – a city which is the centre of cultural, economic and political life of the country. Prague is located on several hills along the Vltava river and its historical centre is one of the best preserved and most picturesque in Europe.

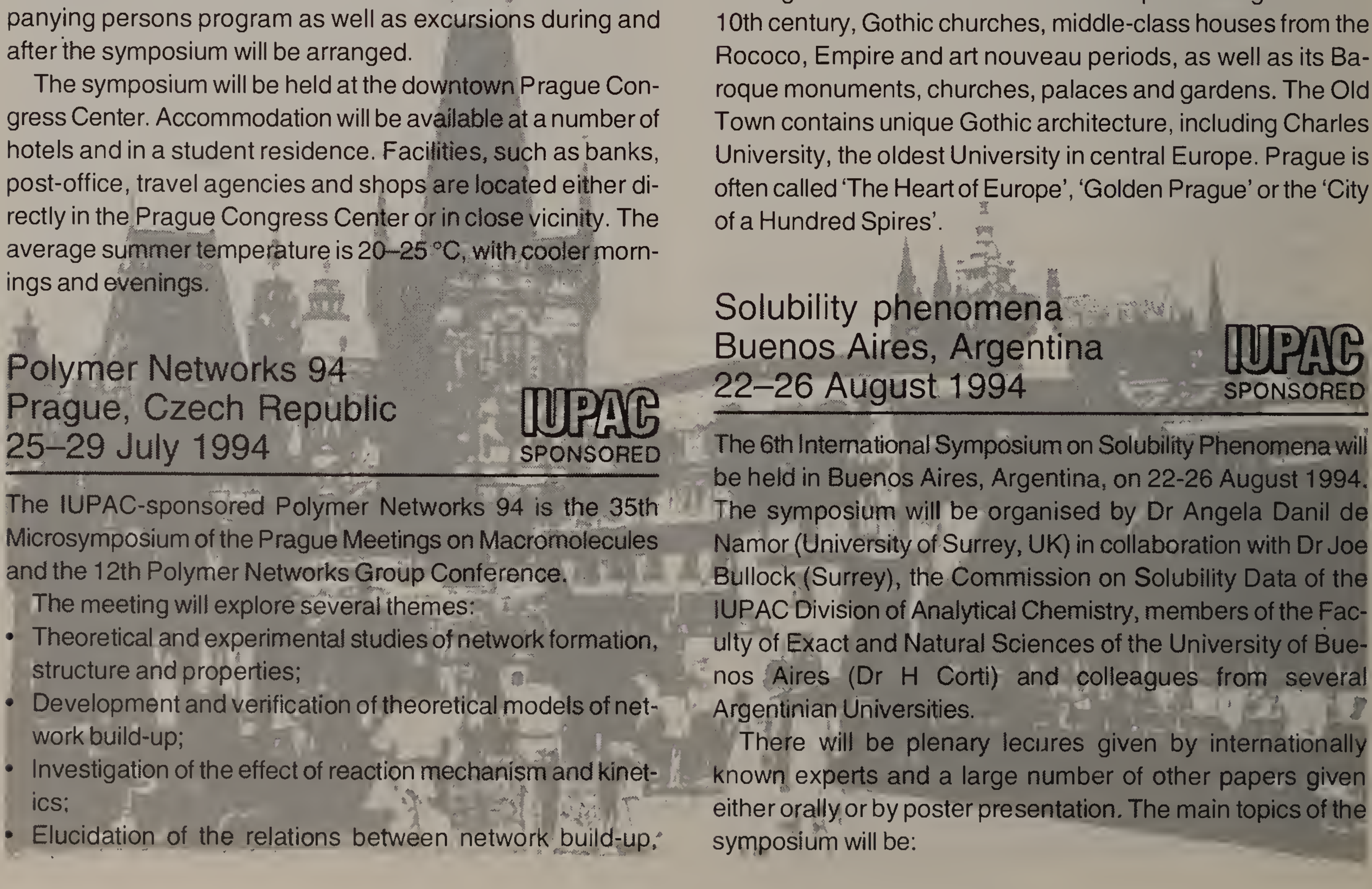
The symposium aims to gather photochemists to discuss topics of current interest. The meeting will consist of about 14 plenary lectures of 50 minutes and 10 short lectures of 25 minutes, as well as poster sessions. The main topics of the symposium will be:

- Organic photochemistry and photophysics;
- Inorganic photochemistry and photophysics;
- Polymer photochemistry and photophysics;
- Theory of photochemical reactions;
- Photochemical kinetics and spectroscopy.

All lectures will be presented in English.

The registration fee will be USD 300 for participants, USD 100 for students and participants from East European countries, and USD 150 for accompanying persons. IUPAC affiliate members are entitled to a 10% reduction. An accompanying persons program as well as excursions during and after the symposium will be arranged.

The symposium will be held at the downtown Prague Congress Center. Accommodation will be available at a number of hotels and in a student residence. Facilities, such as banks, post-office, travel agencies and shops are located either directly in the Prague Congress Center or in close vicinity. The average summer temperature is 20–25 °C, with cooler mornings and evenings.



Polymer Networks 94
Prague, Czech Republic
25–29 July 1994

The IUPAC-sponsored Polymer Networks 94 is the 35th Microsymposium of the Prague Meetings on Macromolecules and the 12th Polymer Networks Group Conference.

The meeting will explore several themes:

- Theoretical and experimental studies of network formation, structure and properties;
- Development and verification of theoretical models of network build-up;
- Investigation of the effect of reaction mechanism and kinetics;
- Elucidation of the relations between network build-up, structure, and physical and material properties of systems important for various applications.

There will be seven topics:

1. Statistical and kinetic (coagulation) models of network build-up;
2. Computer simulation of network formation;
3. Critically branched state-critical exponents, scaling;
4. Rheology of branching systems;
5. Diffusion control of kinetics of cross-linking, physical ageing;
6. Dynamic and static properties of networks;
7. Cross-linked elastomers, thermosets, coatings, gels.

The following scientists have been invited to present main lectures: M. Antonietti (Germany), C. D. Eisenbach (Germany), R. J. Farris (USA), M. Fischer (Switzerland), V. Galiatsatos (USA), K. Horie (Japan), O . Kramer (Denmark), J. E. Mark (USA), J.-P Pascault (France). B. A. Rosenberg (Russia), R. J. J. Williams (Argentina).

All scientific sessions of the meeting will be held at the Institute of Macromolecular Chemistry (Academy of Sciences of the Czech Republic) in Prague. The Programme includes 11 main lectures, 15 special lectures and poster communications. The official language of the meeting will be English. The approximate registration fees are CHF 425 for active participants and CHF 115 for accompanying persons.

Accommodation will be available in halls of residence in the vicinity of the institute. Hotel accommodation will be provided for invited main lecturers.

Prague is renowned for its Romanesque buildings from the 10th century, Gothic churches, middle-class houses from the Rococo, Empire and art nouveau periods, as well as its Baroque monuments, churches, palaces and gardens. The Old Town contains unique Gothic architecture, including Charles University, the oldest University in central Europe. Prague is often called 'The Heart of Europe', 'Golden Prague' or the 'City of a Hundred Spires'.

Solubility phenomena
Buenos Aires, Argentina
22–26 August 1994

The 6th International Symposium on Solubility Phenomena will be held in Buenos Aires, Argentina, on 22-26 August 1994. The symposium will be organised by Dr Angela Danil de Namor (University of Surrey, UK) in collaboration with Dr Joe Bullock (Surrey), the Commission on Solubility Data of the IUPAC Division of Analytical Chemistry, members of the Faculty of Exact and Natural Sciences of the University of Buenos Aires (Dr H Corti) and colleagues from several Argentinian Universities.

There will be plenary lecures given by internationally known experts and a large number of other papers given either orally or by poster presentation. The main topics of the symposium will be:

Faculty of Exact and Natural Sciences of the University of Buenos Aires

- Solution thermodynamics
- New solubility data (gases, electroytes and non-electrolytes)
- Supramolecular systems - solubility aspects
- Pollutant solubilities and environmental chemistry
- Solubilities of polymers, micelles and pharmaceuticals
- Molten systems (salts, glasses, metals) and hydrothermal systems

The registration fees before/after 1 March 1994 will be USD 300/350 for participants; USD 60/75 for students and USD 80/100 for accompanying persons. IUPAC affiliate members are entitled to a 10% reduction. An accompanying person programme including excursions during and after the symposium will be arranged. The symposium will be held at the Bauen Hotel, Buenos Aires but accommodation for delegates and others at smaller, neighbouring hotels will be possible. The Bauen Hotel has excellent conference facilities as well as the other facilities expected from a first-class hotel. It is located in the centre of Buenos Aires.

Buenos Aires, one of the most sophisticated Latin American cities, has a rich tradition and an exciting present. The city is cool in late August as the season changes to spring so that some warm clothing is recommended.

Near Infrared Spectroscopy

The 6th International Conference on Near Infrared Spectroscopy will be held in Lorne, Victoria, on 18–20 April 1994. This is the first time that such an international meeting has been held in the southern hemisphere. The conference programme has been planned with a view to providing updates on developments in instrumentation, and software, as well as applications.

Further information from: Conference Secretariat, NIR-94, Department of Agriculture, Pastoral and Veterinary Institute, Private Bag 105, Hamilton, Victoria 3300, Australia. Tel.: +61 (55) 73 0915; Fax: +61 (55) 71 1523.

Chemistry conference in Cuba

The 14th Conference on Chemistry, organized by the University of Oriente under the auspices of the Chemical Society of Cuba and the Academy of Sciences of Cuba, will be held at the Heredia Theater in Santiago de Cuba, Cuba, on 25–27 May 1994. The languages of the conference will be Spanish and English.

The scientific programme will consist of lectures, round tables and poster sessions. The themes are: inorganic chemistry, organic chemistry, analytical chemistry, physical chemistry, spectroscopy and structure, environmental chemistry, zeolites, biotechnology, chemistry of solutions, X-ray crystallography and chemical education.

Further information from: Dr Marieta Gomez Serrano, Organizing Committee, XIV Conference of Chemistry, University of Oriente, Santiago de Cuba 90500, Cuba. Tel.: +53 226 32263. Fax: +53 226 32689. Telex: 061345 dict.cu. E-mail: quimconf@ispjam.cu.

Polymer analysis and characterization

The 7th International Symposium on Polymer Analysis and Characterization (ISPAC-7) will be held on 23–25 May 1994 in Les Diablerets, Switzerland. This 3-day symposium will consist of poster sessions, invited lectures, and round-table discussions and information exchange on recent advances in polymer characterization approaches, techniques, and applications.

ISPAC-7 will focus on molecular characterization in relationship to properties of polymeric systems. Topics will include aqueous polymeric systems (water-soluble polymers, interacting systems, and physical and chemical gels) and heterogeneous polymeric materials (blends, composites, and multi-layered materials). In addition, an introductory course on polyelectrolytes and the characterization of water-soluble polymers will be held on Sunday 22 May, preceding the symposium.

Further information and registration forms may be obtained from ISPAC Registration, 815 Don Gaspar, Sante Fe, NM 87501, USA. Tel.: +1 (505) 989 4735, Fax: +1 (505) 989 1073; or Dr M. Rinaudo, CERMAV-CNRS, BP 53X, 38041 Grenoble Cedex, France. Tel.: +33 76541145, Fax: +33 76547203.

Formulations Forum ' 94

Formulations Forum '94 will be held at the Washington Hilton Hotel, Washington, DC, USA, on 30 June – 1 July 1994, immediately preceding the IUPAC-sponsored 8th International Congress of Pesticide Chemistry. The forum is the first symposium specifically devoted to formulations chemistry. Its theme is 'Agrichemical formulations for the 90's and beyond'.

The forum will highlight the following topics: drift reduction; protecting against inactivation (UV, pH, temperature, etc); packaging technology and trends; microencapsulation; leaching inhibition; penetration and translocation; water dispersible granules – use, production methods, trends; ECs and microemulsions; emulsion dispersion concentrates and gels; formulating for the home and garden market; adjuvants – current and future; pyrrolidone/silicone adjuvants; seed coating and granular technologies; fertlizer technologies for delivery and environmental protection.

For further information and registration information please contact: Formulations Forum '94, 1361 Alps Road Wayne, NJ 07474-0961, USA or call the Agri Hotline: +1 (201) 628-3951.

Plan now to attend

FORMULATIONS FORUM 94

The world's first international symposium on pesticide formulations

30 June and 1 July 1994
Washington Hilton Hotel
Washington, DC USA

- Join formulations and pesticide chemists and other world-renowned professionals
- Learn about new technologies, issues and trends from international experts
- Participate in discussions on all phases of inerts, adjuvants and regulatory developments in America, Asia and Europe

For a program brochure and registration information, call the Agri HotLine:
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Formulations Forum '94 Highlights

- Drift reduction
- Protecting against inactivation (UV, pH, temperature, etc.)
- Packaging technology and trends
- Microencapsulation
- Leaching inhibition
- Penetration and translocation
- Water dispersible granules — use, production methods, trends
- ECs and microemulsions
- Emulsion dispersion concentrates and gels
- Formulating for the home and garden market
- Adjuvants — current and future

Program Chairman: Dr. Chester L. Foy, Virginia Polytechnic Institute and State University
Sponsored by International Specialty Products, Wayne, NJ

FORMULATIONS FORUM 94

Mail to: Formulations Forum '94
1361 Alps Road Wayne, NJ 07474-0961 USA

☐ I would like to attend Formulations Forum '94. Please send me registration information.

☐ Register me right away. My registration fee (US $795) is enclosed.

Name
Title Affiliation
Address
City State Country
Telephone Fax

Conference Calendar

1994

Pesticide chemistry

4–9 July
8th International Congress of Pesticide Chemistry. Washington, DC, USA.
Dr. J. R. Plimmer, ABC Laboratories, 7200 ABC Lane, PO Box 1097, Columbia, MO 65205, USA.

Inorganic membranes

10–14 July
3rd International Conference on Inorganic Membranes. Worcester, MA, USA.
Prof. Y. H. Ma, Department of Chemical Engineering, Worcester Polytechnic Institute, 100 Institute Road, Worcester, MA 01609-2280, USA.

Macromolecules

11–15 July
35th International Symposium on Macromolecules. Ohio, USA.
Macroakron'94, Cathy Manus-Gray, Symposium Coordinator, Institute of Polymer Science, The University of Akron, Akron, OH 44325-3909, USA. Tel: +1 (216) 9725334. Fax: +1 (216) 9725463. E-Mail: Manusgray@UAkron.

Chemical thermodynamics

17–22 July
13th International Conference on Chemical Thermodynamics. Clermont-Ferrand, France.
Prof. J.-P. E. Grolier, Laboratoire de Thermodynamique et Génie Chimique, Université Blaise Pascal, Clermont-Ferrand, F-63177 Aubière Cédex, France. Tel: +33 73407186. Fax: +33 73407185.

Carbohydrates

17–22 July
17th International Carbohydrate Symposium. Ottawa, Canada.
Dr. H. Jennings, Institute of Biological Sciences, National Research Council of Canada, 100 Sussex Drive, Ottawa, Ontario, Canada, K1A OR6.

Photochemistry

17–22 July
15th IUPAC Symposium on Photochemistry. Prague, Czech Republic.
Prof. I. Stibor, Prague Institute of Chemical Technology (PICT), Department or Organic Chemistry, Technická 5, 166 28 Prague 6, Czech Republic. Tel: +42 (2) 3111790. Fax: +42 (2) 3119919. E-mail: stibori@vscht.cs

Excitonic processes in condensed matters

19–22 July
International Conference on Excitonic Processes in Condensed Matters. Darwin, Australia.
Dr. J. Singh, EXCON 94, Faculty of Science, Northern Territory University, P.O. Box 40146, Casuarina, NT 0811, Australia. Tel: +61 (89) 466811. Fax: +61 (89) 410460. E-mail: singhjai@darwin.ntu.edu.au.

Local air pollution

20–21 July 1994
International Workshop on Local Air Pollution in Rapidly Developing Countries. Zhen De, Beijing, China.
Prof. Xiaoyan Tang, Center of Environmental Sciences, Peking University, Beijing 100871, China. Tel: +86 (1) 2501925. Fax: +86 (1) 2501927. E-mail: TangXY@BEPC2@SCS.SLAC.STANFORD.EDU.

Coordination chemistry

24–29 July
30th International Conference on Coordination Chemistry.
Kyoto, Japan.
Prof. H. Ohtaki, Laboratories of Coordination Chemistry, Institute for Molecular Science, Myodaiji-cho, Okazaki 444, Japan.

Polymer networks 94

25–29 July
35th Microsymposium on Macromolecules.
Prague, Czech Republic.
35th Microsymposium, P.M.M. Secretariat, c/o Institute of Macromolecular Chemistry, Academy of Sciences of the Czech Republic, Heyrovsky Sq. 2, 162 06 Prague 6, Czech Republic. Tel: +42 (2) 360341. Fax: +42 (2) 367981. E-mail: SYMPO@IMC.CAS.CZ. Telex: 122019 imcp c.

Chemical education

8–12 August
13th International Conference on Chemical Education. Chemistry: The Key to the Future.
Puerto Rico.
Dr Ram S. Lamba, Metropolitan Campus, Inter American University of Puerto Rico, PO Box 191293, San Juan, PR 00919-1293, Puerto Rico. Tel: +1809 250 8379. Fax: +1809 765 2055 or +1 809 250 0782.

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Raman spectroscopy

22–26 August
14th International Conference on Raman Spectroscopy. Hong Kong.
Prof. Nai-Teng Yu, Department of Chemistry, The Hong Kong University of Science & Technology, Clear Water Bay, Kowloon, Hong Kong. Tel: +852 3587358. Fax: +852 3581594. E-mail: ICORS@USTHK.BITNET

Solubility phenomena

22–26 August
6th International Symposium on Solubility Phenomena. Buenos Aires, Argentina.
Dr. Angela F. Danil de Namor, Department of Chemistry, University of Surrey, Guildford, Surrey, UK. Tel: +44 (483) 300800, ext. 2588. Fax: +44 (483) 300803.

Physical organic chemistry

28 August – 2 September
12th International Conference on Physical Organic Chemistry. Padova, Italy.
Prof. F. Di Furia, Department of Organic Chemistry, Via Marzolo 1, I-35131 Padova, Italy. Tel: +39 (49) 831297. Fax: +39 (49) 831222. E-mail POC12@CHOROO.UNIPD.IT.

Macrocyclic ligands

29 August – 1 September
2nd International Symposium on Macrocyclic Ligands for the Design of New Materials. Buenos Aires, Argentina.
Dr. Angela F. Danil de Namor, Department of Chemistry, University of Surrey, Guildford, Surrey GU2 5XH. Tel: +44 (483) 300800, ext. 2588. Fax: +44 (483) 300803.

Liquid crystal polymers

6–9 September
International Conference on Liquid Crystal Polymers. Beijing, China.
Prof. Xibai Qiu, Chinese Chemical Society, PO Box 2709, Beijing 100080, China.

Thermal analysis and calorimetry

11–16 September
6th European Symposium on Thermal Analysis and Calorimetry (ESTAC). Grado, Italy.
Prof. A. Cesàro, Dipartimento di Biochimica, Biofisica E, Chimica Delle Macromolecole, Via Valerio 22, I-34127 Trieste, Italy.

Geotoxicology

18–22 September
International Conference on Geotoxicology: Mutagens and Clastogens in the Environment. Oxford, UK.
Dr Katherine J. Kaye, School of Geography, University of Oxford, Mansfield Road, Oxford, OX1 3TB, UK. Tel: +44 (865) 271929. Fax: +44 (865) 271929

Medicinal chemistry

19–23 September
13th International Symposium on Medicinal Chemistry. Paris, France.
Administrative Secretariat, Convergences – ISMC '94, 120 avenue Gambetta, 75020 Paris, France. Fax: +33 (1) 40310165. Telex: 216911F.

Molecular mobility and order in polymer systems

3–6 October
International Symposium on Molecular Mobility and Order in Polymer Systems. St. Petersburg, Russia.
Prof. A. A. Darinskii, Institute of Macromolecular Compounds, Russian Academy of Sciences, Bolshoy pr. 31, St. Petersburg, 199004 Russia.

Functional & high performance polymers

14–16 November 1994
International Symposium on Functional & High Performance Polymers. Taipei, Taiwan, P. R. China.
Prof. Leo-Wang Chen, National Taiwan University, Department of Chemical Engineering, Taipei, Taiwan, People's Republic of China.

Organic synthesis

11–16 December
10th International Conference on Organic Synthesis. Bangalore, India.
Prof. G. S. R. Subba Rao, (Secretary, ICOS-10), Department of Organic Chemistry, Indian Institute of Science, Bangalore 560 012, India.

1995

Analytical chemistry

9–15 July
SAC 95: International Conference on Analytical Chemistry. Hull, UK.
Prof. A. Townshend, School of Chemistry, University of Hull, Hull HU6 7RX, UK. Tel: +44 (482) 465027. Fax: +44 (482) 466410.

Toxicology and clinical chemistry of metals

10–13 July
5th COMTOX Symposium on Toxicology and Clinical Chemistry of Metals. Vancouver, BC, Canada.
Prof. F. W. Sunderman, Jr., Departments of Laboratory Medicine and Pharmacology, University of Connecticut Medical School, Post Office Box 1292, Farmington, Connecticut 06034-1292, USA. Tel: +1 (203) 792328. Fax: +1 (203) 6792154.

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PERSPECTIVES IN CATALYSIS

CHEMISTRY FOR THE 21ST CENTURY

IUPAC

Edited by **J.M. Thomas**, The Royal Institution of Great Britain, and **K.I. Zamaraev**, Institute of Catalysis of USSR Academy of Sciences

Catalysis is considered as one of the top research frontiers of chemistry. It is the backbone of the chemical industry and hence the key to the production of fabrics, foodstuffs, fuels and pharmaceuticals. It is also a fundamental feature of all life processes. The last three decades have witnessed a shift from phenomenological approaches to structured and mechanistic investigations at the molecular level, using new sophisticated and very powerful instrumentation, quantum chemical calculations and other computational methods. On the eve of the 21st century new ideas emerging from basic research in catalysis promise breakthroughs that may change the profile of industries in the future. This is particularly true of the chemical and petroleum industries where technologies based on catalysis already play a dominant role. Given the profound effect that advances in this area will have upon our industries in the coming century, it is perfectly proper that one of the first books in this series should be dedicated to catalysis.

- **catalysis is considered worldwide as one of the top research frontiers in chemistry**
- **catalysis is the backbone of chemistry and thus the key to the production of many of our basic materials**
- **recent advances are poised to have a dramatic effect on the efficiency, safety and quality of our industries**
- **contributions to this volume come from an expert, international authorship**
- **an essential and timely reference for industrial, research and postgraduate chemists, and those working in the petroleum and energy industries**

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Catalysis with giant palladium clusters

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The International Union of Pure and Applied Chemistry (IUPAC), formed in 1919, is a voluntary non-governmental, non-profit association of organizations, each of which represents the chemists of a member country.

Its objectives are:

- to promote continuing co-operation among the chemists of the member countries;
- to study topics of international importance to pure and applied chemistry which need regulation, standardization, or codification;
- to co-operate with other international organizations which deal with topics of a chemical nature;
- to contribute to the advancement of pure and applied chemistry in all its aspects.

The membership of IUPAC presently comprises 40 countries, each represented by a national organization, such as an academy of science or research council.

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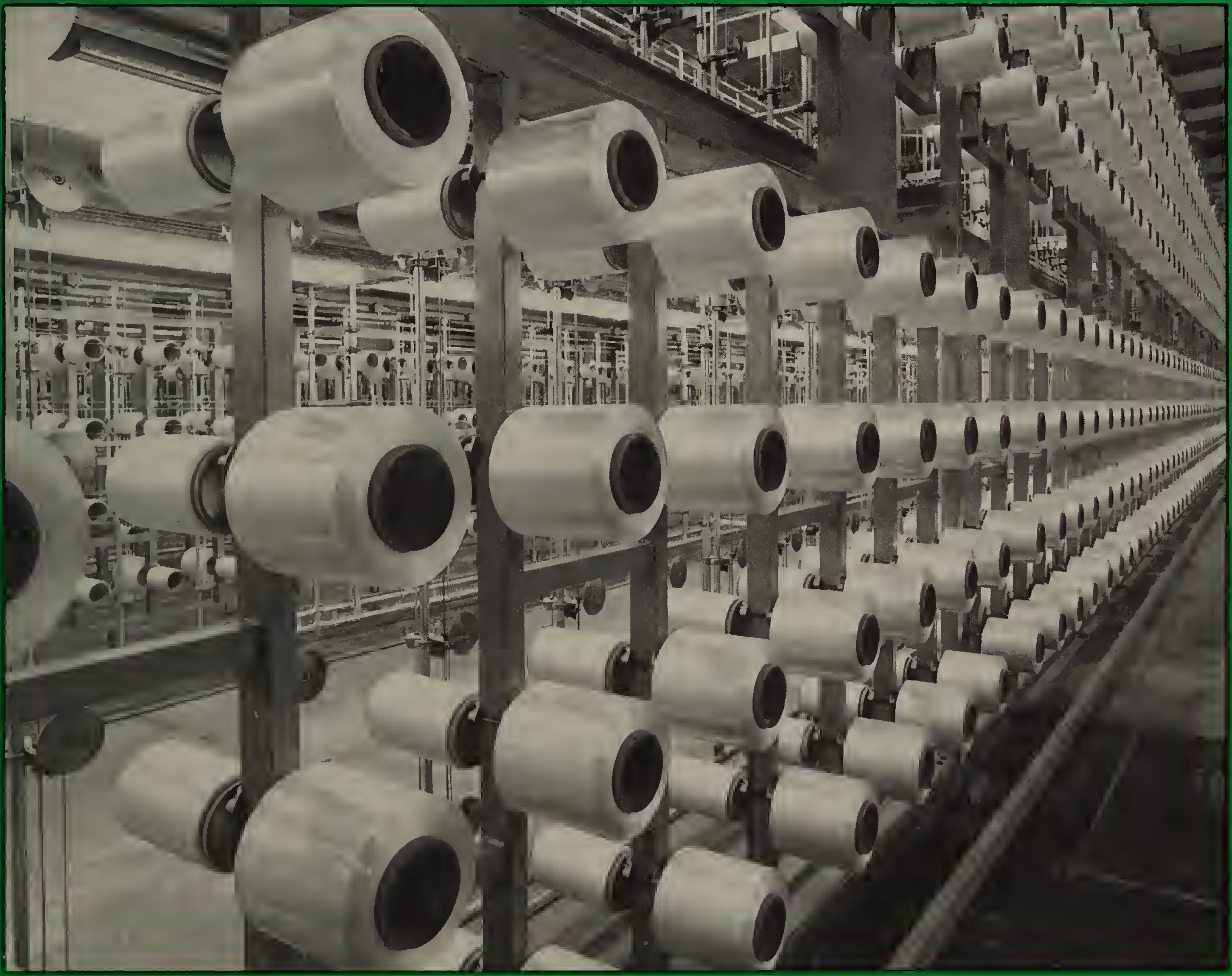
0193-6484(199403)16:2:1-L

Printed in England by Honey Press Ltd. (Banbury)

ISSN 0193-6484

Chemistry International

The news magazine of the International Union of Pure and Applied Chemistry (IUPAC)



IUPAC

1994, Vol. 16. No. 3 (May)

Blackwell Scientific Publications

Chemistry International

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Front cover: Manufacture of TREVIRA fibres at the Bobingen factory in Germany. (*Photo HOECHST AG*).

The Beijing Congress

The 34th IUPAC Congress took place in Beijing, China from Sunday 15th to Friday 20th August 1993. Sessions were devoted to organic chemistry, analytical chemistry, inorganic chemistry, polymer chemistry, petrochemistry, physical chemistry, computers in chemistry and chemistry teaching. The following review of the Congress is based on the report of the Chinese Chemical Society and the published proceedings.

Introduction

The 34th IUPAC Congress was held at the Beijing International Convention Center from Sunday 15th to Friday 20th August 1993. The theme of the Congress was 'Chemistry for the 21st Century: The Central Science'. The Congress covered widely differing fields in chemistry and provided a critical survey of the current state of knowledge and future trends in eight fields of chemistry.

Nearly 1000 scientists from 49 countries attended the Congress. These included 408 participants from outside mainland China. A total of 919 papers were presented. Several internationally famous chemists including two Nobel Prize winners were invited to present plenary lectures. Amongst the many world famous Chinese scientists who attended the Congress were 26 members of the Chinese Academy of Sciences. This distinguished gathering ensured that the Congress reached a high academic standard and served as a bridge linking Chinese chemists with the global community of chemists.

The percentage of young Chinese chemists attending the Congress was high. Their advanced scientific research qualifications and achievements and their ability to communicate science bodes well for the future of chemical research in China.

During the Congress, General Secretary, Mr. Zeming Jiang, received Nobel Prize winners Prof. Yuan T. Lee and Prof. R. R. Ernst as well as IUPAC Vice-President Prof. H. Staab. Mr Jiabao Wen, from the Central Committee of CCCP, attended the opening ceremony of the Congress and offered greetings to all participants. Many other famous scientists attended the Congress. These included Prof. Jiaxi Lu (former President of the Chinese Academy of Science), Prof. Guangzhao Zhou (Current President of CAS), Prof. Aoqing Tang (President of the Chinese Chemical Society), Prof. Cunhao Zhang (IUPAC Bureau Member) and Prof. Guangxian Xu (President of the Federation of Asian Chemical Society).

Beijing University (top left), Great Wall of China (bottom) and Headquarters of the Chinese Chemical Society (CCS) in Beijing (above).

The scientific program

The scientific program of the Congress was devoted to the following eight sections:

Section 1. Life science and organic chemistry
- Chemistry for more food – plant hormones and growth regulators, agrochemicals, food chemistry
- Chemistry for better health – natural drugs, molecular design and synthesis of pharmaceuticals
- Clinical chemistry
- Pharmaceutical chemistry
- Chemistry of bioactive molecules, nucleic acids, proteins, polypeptides and carbohydrates
- Enzymes and their interactions with substrates
- Chemistry in biotechnology
- Organic chemistry of natural products
- Physical organic chemistry

Section 2. Chemistry for a better environment and analytical chemistry
- Environmental monitoring and protection
- Cleaner atmosphere, water and soil
- Safety in chemical production, handling hazardous materials
- Safe disposal and recycling of wastes
- Chemical separation and concentration
- Various optical and resonance methods of analysis
- Electroanalytical chemistry
- Chromatography, mass spectrometric analysis and various combination techniques
- Bioanalytical chemistry, pharmaceutical analysis
- Chemical analysis and protection of cultural relics

Section 3. Chemistry of advanced materials and inorganic chemistry
- Advanced alloys and intermetallic compounds
- High performance ceramics
- Optoelectronic materials and functional crystals, thin films
- Molecular design for new advanced materials
- Coordination chemistry and bioinorganic chemistry
- Organometallic and cluster chemistry
- Rare-earth chemistry and advanced materials
- Nuclear and radiochemistry
- Solid-state chemistry

Section 4. New polymer materials and macromolecular science
- Polymer materials with special optical, electrical, biological and other functional properties
- Polymeric liquid crystals, composite and hybrid materials
- Polymerization, characterization, structure – property relationships and applications of polymers

Section 5. Petrochemistry, fossil fuels chemistry and catalysis
- C1 chemistry, activation of small paraffin molecules
- Conversion of petroleum residues
- Heterogeneous and homogeneous catalysis, new catalysts
- Photo-, electro- and artificial enzyme catalysis
- Theoretical and experimental studies on mechanisms of catalysis

Section 6. Physical chemistry
- Thermodynamics and energy sources
- Structural chemistry and modern spectroscopy
- Quantum chemistry and statistical chemistry
- Chemical kinetics and molecular dynamics
- Electrochemistry, photochemistry and electrophotochemistry
- Colloids and surface chemistry

Section 7. Chemical information and computers in chemistry
- Data banks and processing
- Chemometrics
- Applications of computers in chemistry and chemical engineering
- Simulation and modelling

Section 8. Popularization and education of modern chemistry
- Modernization in teaching chemistry
- Experimental chemistry teaching
- Computer aids in chemistry teaching

Plenary lectures

There were eight plenary lectures:
Prof. Ronald Breslow (Columbia University, USA)
Prof. Richard Ernst (ETH, Switzerland)
Prof. Xikui Jiang (Shanghai Institute of Organic Chemistry, China)
Prof. Yuan T. Lee (University of California, Berkeley, USA)
Dr W. Graham Richards (Oxford University, UK)
Prof. Heinz A. Staab (IUPAC, Germany)
Prof. Dong-Sheng Yan (Chinese Academy of Sciences, China)
Prof. Jerzy Haber (Institute of Catalysis and Surface Chemistry, Poland)

The following review of the scientific programme of the Congress is based on the abstracts of the plenary lectures published in the *Proceedings of 34th IUPAC Congress*. The full texts of these lectures will be published in a forthcoming issue of *Pure and Applied Chemistry*.

Professor Heinz Staab (fourth from right) with officers of the Chinese Chemical Society.

Steering chemical reactions through laser excitation

This was the title of Yuan T. Lee's plenary lecture. Lee pointed out that in many elementary chemical reactions, there are several reaction pathways producing various products, some of which are more often desirable than others. It has long been the dream of chemists to be able to steer such chemical reactions in a desirable direction.

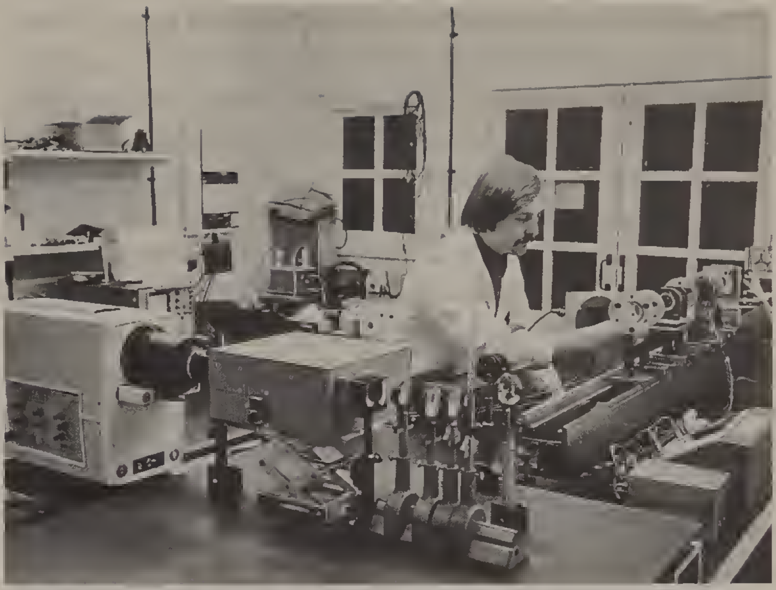
Over the past few decades, especially with the arrival of tunable lasers, laser excitation of reagent atoms and molecules has been extensively investigated with the aim of accomplishing bond selective or mode specific chemistry.

For chemical reactions with potential energy barriers, excitation of molecular vibrations using infrared lasers often enhances the rates of reactions appreciably. This is especially true for diatomic molecules in which the deposition of energy is entirely in the bond to be broken. For bent triatomic molecules, there are three vibrational degrees of freedom, and in reactions with atomic reagents, various reaction channels which involve different movements of the atoms in the triatomic molecules are directly related to specific vibrational modes.

This is the reason why chemists have been trying to control chemical reactions through mode selective vibrational excitations. For example, if an atom attacks the central atom of a bent triatomic molecule, and induces two end atoms to form diatomic products, one can easily see that the reaction coordinate is associated with the bending mode of the triatomic molecule. Lee said that one expects to be able to promote this channel by using an infrared laser to excite the bending vibration. On the other hand, the excitation of the antisymmetric stretching mode is expected to facilitate the abstraction of the end atom. However, the random nature of molecular collisions with unfavourable approaches induces vibrational relaxation and the dream of a selective chemical reaction through mode selective excitation does not produce satisfactory results.

In the middle of the 1970s the hope for mode selective chemistry was ignited again when it was discovered that the initial excitation of molecules in an IR multiphoton excitation process is through specific vibrational rotational transitions. It is not surprising to expect that the outcome of the molecular dissociation through infrared multiphoton dissociation might depend on the mode through which energy is deposited. Unfortunately, this dream was again not fulfilled due to very fast intramolecular energy transfer in highly vibrationally excited molecules.

Although the mode selective chemistry of polyatomic molecules was not found to be successful in the ground electronic state, there were some exciting successes in the bond selective photodissociation of haloalkanes. In CH_2BrI, it was found to be possible to use 210 nm photons to induce the n ♦ σ^* transition involving the C–Br bond to selectively dissociate a stronger C–Br bond and keep the weaker C–I bond intact. In recent studies of photodissociation of HDO by Crim *et al.*, and reactions with H atoms by Zare and coworkers, it has been clearly demonstrated that bond selective chemistry can be accomplished by exciting either OH or OD bonds by infrared photons.



Lasers have been used extensively in recent years to investigate the pathways of chemical reactions.

According to Lee, 'there are many molecules, the electronic excited states of which have different molecular structures such that in the electronic excitation, various vibrational modes or combination bands can be excited simultaneously'. If the predissociation of these electronically excited molecules turns out to be very fast (about one picosecond), then there is a probability that various vibrational excitations in the electronically excited state might affect the outcome of molecular dissociation. Such a process, namely, mode specific photodissociation through electronic excitation, was indeed observed in the photodissociation of ClO_2 molecules.

Finally, Lee discussed in detail the mode specific dissocation of ClO_2 into either $Cl + O_2$ or $ClO + O$ products, as well as the possibility of steering bimolecular chemical reactions, either through the alignment of the electronically excited atomic orbital along the relative velocity vector, or modifying the separation of first and second electron transfer distance in the reaction of divalent atoms forming ionic products.

The use of NMR to study molecular structure and dynamics

Nobel Laureate Richard R. Ernst presented a plenary lecture on 'Recent developments in NMR methodology for the study of molecular structure and dynamics'. His lecture provided a survey of the possibilities of nuclear magnetic resonance (NMR) for the elucidation of the structure and in particular of the internal dynamics of molecules. NMR has unique features with the abundance of localized sensors in molecules that provide information on structural and motional features in their immediate vicinity.

Ernst pointed out that powerful techniques for structural investigations have been worked out over the past decade. The combination of COSY and NOSEY and their variants have become routine tools for the conformational analysis of biological macromolecules. Two-dimensional spectroscopy has been extended to three and four dimensions involving homonuclear and heteronuclear transfer of polarization and coherence, leading to extremely versatile tools for the chemist and the biologist to clarify structural features.

Ernst noted that while the investigation of rigid molecular structures is well established, the study of dynamics in molecules is by orders of magnitude more difficult. The numbers of parameters needed to characterize motion by far exceeds that of structural parameters. NMR allows access to motional parameters through relaxation measurements in the laboratory frame and in the rotating frame and through the observation of averaged spectral parameters. The description of motion invariably affords the development of simplified models that can be tested by a comparison with experimental results, possibly combined with numerical molecular dynamics simulations.

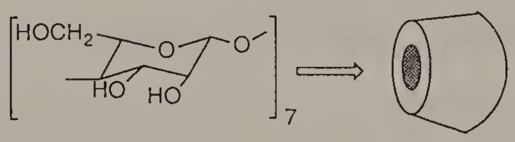
The application of NMR for the study of intramolecular dynamics is illustrated by an investigation of the cyclic decapeptide antamanide. Ernst examined three different types of motion in detail:

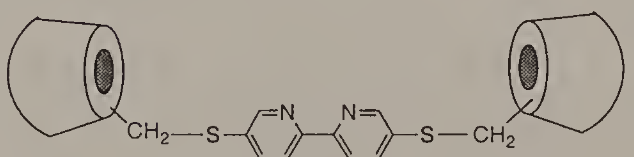
- A torsional mode of the peptide ring was investigated using a new analysis procedure known as MEDUSA. A model with two conformational states was developed.
- The proline ring puckering motion was studied by J-coupling measurements and by molecular dynamics computer simulation. It was found that two of the four proline rings were rigid while two underwent an envelope-type motion.
- The side-chain dynamics was analysed by the measurement of cross-correlated relaxation measurements.

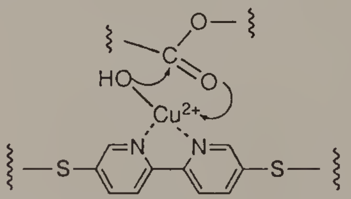
Biomimetic chemistry

In his lecture on 'Biomimetic chemistry', Ronald Breslow stated that enzymes and antibodies generally bind substrates using multiple interactions, leading to high binding constants for antigens or for transition states. Breslow's team has prepared a series of receptors that combine two cyclodextrins, and find that with substrates having the correct geometry the affinities can be extremely high, approaching the best antibodies.

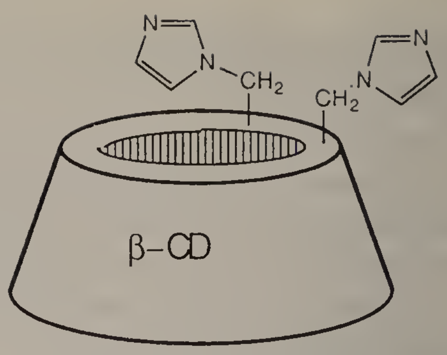
Quantitative studies with antihydrophobic agents help account for the observed binding. At the same time, when catalytic functional groups are incorporated into such molecules, high rates and selectivities are observed for catalysed reactions:







Enzymes also commonly use two (or more) catalytic groups to achieve their high effectiveness. Breslow described systems that imitate this feature and presented evidence for the mechanisms used by their bifunctional catalysts. In some cases these studies also furnish insights into the mechanisms of the corresponding enzyme processes.



Finally, he pointed out that the work he had described had been done by a gifted group of graduate students and postdoctoral fellows. The most recent studies were the work of two particularly able Chinese graduate students – Zhang Biliang and Xu Ruo.

Advanced nitride materials design

Dong-Sheng Yan delivered a lecture on 'Material chemistry studies – their role for advanced nitride materials design'. He said that the essential elements of materials science and engineering (MSE) are generally recognized as composed of synthesis and processing, composition and structure (microstructure), properties and performance. These elements are closely interrelated. It is, therefore, evident that MSE is highly multidisciplinary. In his paper, Yan discussed advanced nitride ceramics and particularly how their phase composition and microstructure can be designed to meet specific property requirements with the help of material chemistry studies.

The family of advanced nitride ceramics materials has exhibited extremely encouraging properties – especially at high temperature said Yan. He reported that 'the possibility for compositional design of such multiphased materials on a more scientific basis to better serve at more stringent performance conditions has been a subject of intensive research in recent years'. He addressed this problem from two chemical approaches.

For the design of the major crystalline phases, a comprehensive knowledge of the phase equilibrium relationships between different constituents is essential. Yan took the multicomponent Si, Al, Y, N, O system as an example. Within this system, Yan's team have identified '76 compatibility regions after around ten years work in close collaboration with several world renowned laboratories. Among them, there are about a dozen which can serve as the basis for the generation of high performance materials.' Further, to fabricate a good material with reproducibility and reliability, the reaction kinetics (sequence) between different constituents comes into full play during high temperature processing. Therefore, materials processing is another important area of research that should never be overlooked, according to Yan.

As a multiphase, polycrystalline material, there are grain boundary phase regions. The tailoring and microstructural control of these are no less important as far as their influence on material properties is concerned. Yan illustrated this point with some results from his laboratories.

Cholesterols, triglycerides and arteriosclerosis

Xi-Kui Jiang presented a plenary lecture on 'New concepts for studying and understanding the aggregation, co-aggregation, de-aggregation and self-coiling of organic molecules. Why are cholesterols and triglycerides culprits of arteriosclerosis?'

Jiang discussed the structure and medium (SAgP or solvent aggregating power) effects on co-aggregating and coiling tendencies of organic molecules. For instance, it has been proposed that flat molecules without a side-chain have a relatively small tendency towards aggregation brought about by HLI (hydrophobic-lipophilic interaction). Jiang pointed out that geometric shape is an important factor affecting aggregating tendency and that there is a linear dependence of the degree of aggregation on SAgP within a certain range of volume fraction of the organic component of an aquiorgano mixture.

Jiang has proposed and studied the concept of electrostatically stabilized aggregate or ESAg using both kinetic and spectroscopic methods. All data show that in the concentration domain of 10^{-7} to 10^{-5} mol dm^{-3}, two different straight chain molecules with 12–16 CH_2-groups form ESAg only when they are oppositely charged. He added that very recently the ESAg notion has been convincingly supported by observations of the existence of two types of salt effects and of the 'chain-length-matching effect'.

Jiang has proposed that culprit molecules of arterioscolerosis might possess a common and measurable inherent property, namely, a co-aggregating tendency. Kinetic and spectroscopic measurements of these tendencies have led to the discovery of a surprising effect, the 'chain-foldability effect'. This effect easily provides a plausible answer to the question why oleic and linoleic esters rather than stearates are the major components of the plaque of hardened blood vessels.

Jiang has introduced the idea that there might simple be neutral organic molecules that can effectively break up simple aggregates (Ags). These molecules are termed deaggregators or deAgrs. They operate by first getting into the Ag (by virtue of their lipophilicity) and then getting out of the Ag (my virtue of their hydrophilicity) together with another molecule which was one of the members of the Ag.

Catalysis – where science and industry meet

According to Jerzy Haber, in his lecture on 'Catalysis – where science and industry meet', the main objective of human industrial activity is the transformation of materials which are useless into materials that are useful for the mankind. He continued, 'chemical industry, based on the understanding of the relation between the structure of chemical molecules and the properties of materials, provides substances and materials for practically all the other branches of industry and thus determines the development of the whole economy'.

Haber explained that catalysis offers the possibility of fast and selective production of 'the desired chemical molecules, because from among many different possible pathways which given reactants may follow, the catalyst is able to accelerate only one, very often not thermodynamically the most convenient, by modifying the potential energy surface along only this one selected reaction coordinate'. This selectivity of action is the most important and characteristic property of the catalyst, making possible the formation of products which in the absence of the catalyst would have never been formed because of the much more rapidly proceeding competitive processes. Therefore more than 90% of the production of chemical industry is based on catalysis.

'The growth in our knowledge of catalysis has created the conditions for the growth of the fertilizer industry making fertilizers easily available and contributing to the rapid rise in agricultural production,' added Haber. The development of the catalyst to be used in cracking created the basis for the rapidly expanding use of automobiles and aircraft in the 1930s and 1940s. In the early 1950s, due to intensive research on oxide catalysts, active and selective catalysts for oxidation of hydrocarbons by gaseous oxygen were developed. This opened a cheap source of raw materials for the production of the majority of plastics and synthetic fibres.

Catalysis contributes to large-scale processes such as cracking – which is one of the 'greatest technological undertakings of man with more than one billion tons of crude oil per year being processed in this way', and the smallest scale enzymatic reactions with micrograms of product formed with 100% chemo-, regio- and stereoselectivity. Haber said that 'increasingly important is not only the production of materials needed in our modern society, but also the destruction of undesired by-products of its activities. This makes the application of catalysis to pollution control one of the main goals'.

The progress in understanding the structure and properties of chemical bonds combined with the development of surface science, has made it possible to identify the catalytically active centres on the atomic scale and to investigate the properties of isolated transition metal complexes deposited on the surface of a support. Changes of properties may be followed when these complexes are transformed into clusters composed of metal and nonmetal atoms which permit the discrimination between different localized and collective properties of the system determining its behaviour in the catalytic reaction. With the conversion of more and more sophisticated molecules into the desired products, attempts are now being made to answer three fundamental questions:

- What is the structure of the intermediate complex composed of the reacting molecules and the group of atoms of the catalyst constituting the active centre?
- How does the structure of the intermediate complex depend on the properties of the active site and how may it be modified when supported in different locations at the surface of various types of solids?

Catalytic cracking plant in Venezuela. (*Shell photo.*)

- How does formation of the intermediate complex modify the bonds in the reacting molecule, thus influencing its reactivity along different possible reaction pathways and determining the type of product formed and the selectivity of its formation?

Interactions of adsorbed molecules with the surface of a solid not only produce the changes of the structure of the adsorbate, but may also induce the reconstruction of the solid surface, the catalyst being in dynamic interaction with the reactants of the catalytic reaction. The surface may adapt itself to the requirements of the reaction generating a pathway for concerted rearrangement of electrons and atoms of the reacting molecules encountering a much lower activation barrier. Moreover, such surface transformations occurring in the course of the catalytic reaction as the result of the interaction of the reactants with the catalyst, may lead to the appearance of new types of active centres at the catalyst surface, directing the catalytic reaction along a new pathway and thus profoundly influencing the selectivity.

The increasing potential of computational techniques has made it possible to introduce methods of quantum chemistry into the description of elementary stages of catalytic processes. The traditional branches of chemistry, such as organic chemistry, inorganic chemistry, electrochemistry, solid state chemistry, surface science, chemical kinetics, biochemistry and so on, are becoming increasingly integrated into an interdisciplinary science of catalysis. This opens the prospects of the molecular design of catalysts tailored to the needs of the required reaction.

Computer-aided drug design

W. Graham Richards spoke about computer-aided drug design in his plenary lecture at the Beijing Congress. He pointed out that drugs are small molecules which generally act by binding to macromolecules. The design process can be subdivided into two categories depending on whether or not the structure of the macromolecular target is known.

According to Richards, 'conceptually simplest is the case where we start with a good target structure as in the case of nucleic acids, or enzymes whose crystal structures have been solved to high resolution'. With DNA as the target the aim is to design ligands which show sequence specificity. Examples include organo-metallic compounds; spermine derivatives and antisense molecules.

Enzyme inhibitors which can act as anti-cancer agents can have tumour specificity designed into their structure using the notion of bioreductivity: inhibitors which act in the low oxygen environment of tumours, but do not block action in the more oxygen-rich normal tissue. The key to this is the computation of redox potentials, using free energy perturbation methods.

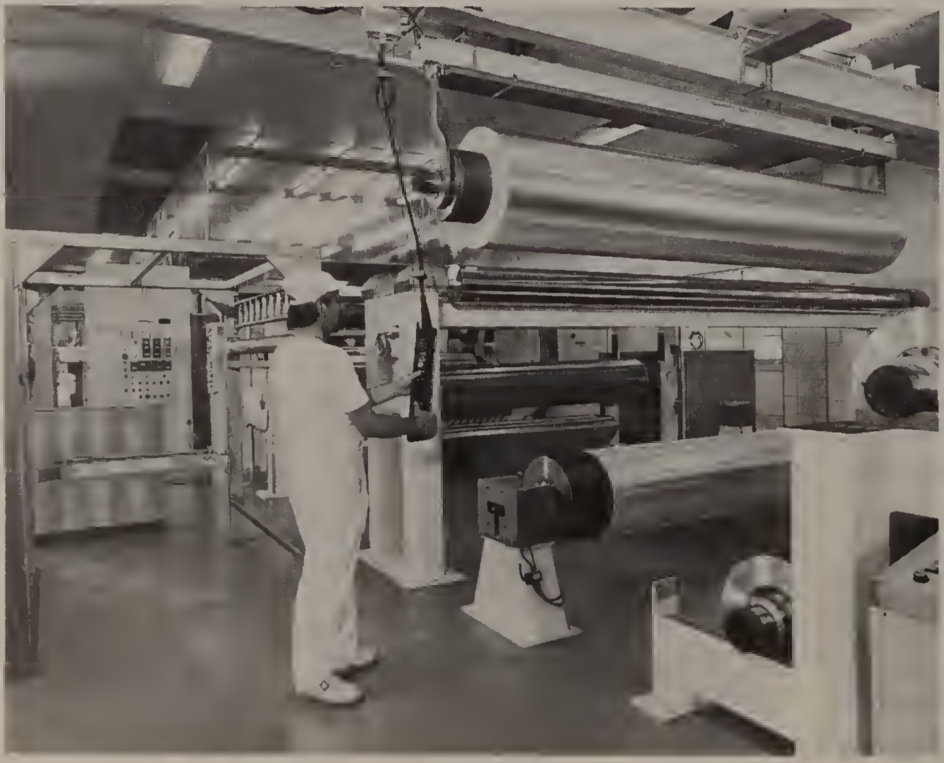
These free energy techniques may also be used to predict the partition of molecules into biological membranes so as to address the problem of drug transport. It is of little use, said Richards, designing an enzyme inhibitor if it cannot gain access to the site where it will act.

Ideally it would not be necessary to have an X-ray structure of a protein to design a drug. Simply the gene sequence would do if it were possible to predict theoretically protein tertiary structures from primary sequence. In general this is not possible, but homology methods are growing increasingly successful. Richards illustrated this by recent work on endothelin and on interleukin 4 and its receptor.

Where the target macromolecule remains an unknown species it may still be possible to design inhibitors of biochemical transformations. Theoretical chemistry may be able to predict transition state structures. Stable mimics, which would inhibit after the manner of penicillin, may be designed with the aid of molecular similarity software.

A broader use of molecular similarity is in the realm of quantitative structure–activity studies. The columns of a matrix of similarity scores between members of a series of active compounds can be used as input to neural networks. These have been shown to produce excellent structure-activity correlations, discriminating between highly active, intermediate and weakly active compounds. The use of partial least squares techniques on the similarity matrices then gives quantitative relationships which seem to out-perform earlier approaches.

The combination of quantum, statistical and molecular mechanics with molecular graphics using workstations and supercomputers has proved to be a powerful aid to drug discovery. Complete computational design is the next step.



The production of a wide variety of plastics and synthetic fibres relies on the use of catalysts. (*Hoechst AG photo.*)

Atmospheric pollution control in India

O. N. Singh and P. Khastgir

This is the third in a series of articles on regional environmental problems prepared by members of the IUPAC Commission on Atmospheric Chemistry*.

Introduction

The problem of pollution control is now recognized as one of global concern. It assumes, however, a special importance in the context of India, with her vast and varied territory and a population of about 900 million people. Apart from giant and densely polluted metropolitan cities, there are more than 3900 cities and towns, each with over 100 000 inhabitants.

The rapid but unfortunately not very well-planned industrial growth during the last four decades, the close proximity of industrial complexes to the cities and residential areas, automobile exhausts continuously belching black smoke, and the fast depletion of forest covers – all have contributed to the increasing detriment of the environment.

The stress on life and environment brought about by pollutants, and a general apathy and indifference to the need for environmental safety measures have led to disasters such as the December 1984 Bhopal tragedy, which claimed thousands of lives and created serious and adverse health problems to many more.

Pollution levels are particularly high in big and densely polluted cities like Calcutta, Bombay, Madras and Delhi. A rough survey in 1987 estimated that 1172 tonnes of suspended particles, hydrocarbons, suphur(IV) oxide, nitrogen oxides, carbon monoxide and other poisonous gases are spewed into the air in Delhi by industrial units, various modes of transport, and power stations.

Trace gases

The least known, and in the context of the global change problem the most critical, are the minor species of the atmospheric constituents. Some significant data for a few of these species in the Indian atmosphere have been obtained in the last decade.

These measurements include the tropospheric as well as stratospheric monitoring of ozone, methane, chlorofluorocarbons (CFCs) and water vapour. One of the various programmes for making such studies and monitoring was carried out over the period January 1982 to March 1989 under the aegis of the Indian Middle Atmospheric Programme (IMAP), which was part of the International MPA activity.

Ozone

All known techniques for ozone measurements, except satellite-borne ones, have been employed for collecting ozone data in the Indian atmosphere.

Over half a dozen Dobson Spectrophotometers have been in use for the total ozone measurements (a few stations being operated for about four decades).

Surface ozone monitoring was initiated in India about two decades earlier. Currently, five stations are operating. Further, balloon-borne ozone measurements are being carried out at four sites – Pune, Delhi, Trivandrum and Dakshin Gangotri (Antarctica) and rockets are used at Thumba. UV-B photometers are employed at seven places – Delhi, Waltair, Jodhpur, Mysore, Shillong, Trivandrum and Pune.

Laser heterodyning systems using tunable CO_2 waveguide lasers are being set up for ozone profiling between 15 and 40 km at the National Physical Laboratory (NPL), New Delhi. This set-up will also be used to monitor water vapour and NO_2 at altitudes up to 20 km. At Bangalore, microwave radiometry is being employed to measure atmospheric ozone and at NPL a new radiometer has been set up.

It is important to note that the Indian Dobson network is amongst the most dense in the tropical regions and in most cases the ozone data is available from IGY (International Geophysical Year) onwards. Out of 71 Dobson stations in the world, only 19 are within 30°N and 30°S and nine within 20°N and 20°S. Of these 19, India has five.

The other major strength of the Indian Ozone Programme is the multiplicity of techniques often used simultaneously or near simultaneously for ozone profile determinations. In this context, the two rocket balloon – ground-based intercomparison campaigns carried out at Thumba as part of the IMAP during 1983 and 1987 are of special value. The Delhi Dobson equipment was calibrated with the world standard at International Intercomparison in Boulder in 1977. The Dakshin Gangotri Station is new and so far has had limited operation. Balloon measurements are available from 1971 onwards. Rocket measurements are relatively recent. UV-B photometry started in NPL several years ago, and with its help a network was established under the auspices of IMAP.

From these ozone measurements at different Indian sites, one finds a very sharp rise in ozone concentrations from the tropopause to higher levels and also a pretty high variability of ozone mixing ratios at tropopause. Since substantial ozone data have been generated in India, one can use them to provide (i) a base reference profile, (ii) trends in ozone changes, and (iii) the nature of ozone depletion. Considering that a good part of the Indian subcontinent lies under the low ozone belt, the last aspect gains additional importance.

Indian ozone data can also provide ozone profile variation with latitude, because the Indian territory covers a fairly large latitudinal range. It must be mentioned that although the results of the total ozone measurements in India have been available for about four decades, no serious detailed trend analysis has been attempted so far. This is the reason that most of the data generated from the Indian Dobson stations have not been included in the WHO-NASA Report on International Ozone Trends Panel, 1988.

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The measurements of other trace gases such as methane (CH_4), nitrogen(I) oxide (N_2O), chlorofluorocarbons (CFCs), other nitrogen oxides (NO_x) and water vapour (H_2O), are far less extensive compared with the ozone measurements. Though some significant work is in progress in this context, very limited data have thus far been collected for the Indian atmosphere.

Methane

The monitoring of methane in India is recent. During the last few years there have been several intensive studies to estimate methane emissions from Indian rice fields. These investigations have revealed that methane emissions from rice fields depends on waterlogging, pH values, temperature, texture and moisture of the soil, crop duration, the variety of the paddy, the mode of cultivation and the phase of the growing the season.

The methane emission has been found to decrease by two orders of magnitude as one goes from waterlogged to irrigated areas. From June 1989 to March 1990, methane studies of rice paddies were carried out in four typical locations: New Delhi, Dehradun, Karnal and Hyderabad. The methane budget was estimated by taking the highest emission rates as well as the average emission rate. These considerations coupled with mapping from satellite remote sensing systems lead to an estimated methane budget from Indian rice paddies of 3–9 Tg (teragrams) per year. This is a preliminary estimate based on the data collected till now. It projects the Indian contribution to be only 6% of the global methane budget of 110 Tg per year and not 30% of the budget due to rice paddy fields, as reported in some calculations.

Also the assumption that the animal population of India contributes to a large extent is probably mistaken. Domestic animals are a major anthropogenic source of methane and India has an estimated 500 million animals compared with some 1200 million cattlehead in the world (in 1980). It is thus assumed that the Indian methane budget on this count must be alarmingly large. However, it should be noted that only 100 million of the 500 million animals are cattle. The rest are sheep and goats. Also, the average weight of Indian cattle is much lower than that in developed northern countries. Taking these considerations into account, the contribution of Indian animals is estimated to be around 7 Tg per year against the global average of 80 Tg per year.

Wetlands also make a significant natural contribution. The emission estimate of this contribution is uncertain at the moment but is definitely lower than that from rice paddies and animals.

Chlorofluorocarbons

Not much has been done with regard to the surface monitoring of CFCs in the Indian atmosphere. On the other hand, a significant amount of work has been carried out under an ongoing Indo-German programme on the monitoring of trace gases in the stratosphere.

The first complete vertical profiles for over 20 trace gases, in particular the halogenated hydrocarbons and halons, for an altitude range of 10–35 km have been generated for tropical latitudes. These have been obtained from the GC and GC-MS analyses of the air samples collected with a balloon-borne cryogenic whole air sampler on 26 March 1987 at Hyderabad. Another successful balloon flight was carried out on 9 April 1990. As in the case of the 1987 flight, 14 whole air samples from different altitudes (10–35 km) were collected. The analytical investigation is in progress.

Other trace gases

It is estimated that the Indian annual contribution of CO_2 to the atmosphere is about 140 Tg against the global total of 6 000 Tg. The CO_2 emissions are mostly due to coal, petroleum, natural gas and transport emissions. These respectively add 85, 35. 5 and 15 Tg of carbon into the atmosphere in a year. Sources and sinks of nitrogen(I) oxide are being investigated.

Recent studies have demonstrated significant efflux of N_2O from grass land and waste land in India. Nitrogen monoxide has been measured with rocket-borne techniques in the mesosphere, but so far not in the troposphere or the stratosphere. Radiosonde techniques gave H_2O concentrations up to 6–8 km. Some stratospheric H_2O measurements were obtained by Soviet scientists by using rocket-borne techniques in the late 1970s over Thumba but the values obtained were estimated to be high. A new high quality ground-based technique has been introduced at NPL, New Delhi, to monitor H_2O in addition to O_3 up to about 25 km.

A major facility known as the Mesosphere–Stratosphere-Troposphere Radar (MST-Radar) has recently been installed near Tirupati to monitor continuously the state of the atmosphere from near the ground to about 90 km (with a gap between 25 to 60 km).

Coal is a major contributor to the carbon budget in the Indian atmosphere. (*ILO photo.*)

According to Singh and Khastgir, individuals and communities alike should receive education on their responsibility towards environmental protection. (*Oxfam photo.*)

Local pollutants

The first organized effort to record comparable, continuous and concurrent data on gaseous and particulate pollutant levels in the ambient air was initiated in India in 1978 in ten cities by the National Environmental Engineering Research Institute (NEERI), Nagpur, as the National Air Quality Monitoring Programme. These cities include Ahmedabad, Bombay, Calcutta, Cochin, Delhi, Hyderabad, Jaipur, Kanpur, Madras and Nagpur.

The idea was to provide data to study the air quality trends on a long term basis. The test rules were selected according to Global Environmental Monitoring norms representing three activity zones: industrial, commercial and residential. Five pollutants were chosen as index parameters which, besides helping to establish the trends of the pollution problem in three major activity zones of urban centres, also defined the problems and highlighted the major contribution sources at the urban centres.

Subsequently, the scope of this study was extended to include:

- Air quality monitoring of index pollutants (SO_2, NO_2, SPM – continued from the first phase) as well industrial emissions including H_2S, mercaptans, F, and NH_3.
- Evaluation of respirable particles fraction in different activity zones.
- Trace and toxic metals (Co, Ca, Cd, Ni, Pb, etc.) PAH and other secondary fractions in different particle size ranges.
- Application of source receptor models in ten urban air basins to apportion contributions from different sources.
- Evaluation of long-term trends.

An analysis of data over 11 years has been made to establish long term trends. Annual mean values of suspended particulate matter (SPM) indicated an increasing trend in Bombay, Cochin, Delhi and Nagpur; SO_2 levels showed a positive trend in Cochin, Delhi and Nagpur; and NO_2 levels showed a positive trend in Bombay, Calcutta, Cochin, Delhi, Hyderabad, Kanpur and Nagpur. Cochin appears to indicate increasing trends with respect to all pollutants. Since thousands of towns and cities in India have begun experiencing the stress of air pollution, it is essential to have such programmes at these places as well.

Concluding remarks

India has extensive programmes on various aspects of global change. These include ozone monitoring and development of CFC substitutes, monitoring of the greenhouse gases along with their budgeting and control, sea level monitoring and modelling, study of air-sea interactions, evaluation of the effects of increased UV-B and climate changes on ecosystems, monitoring of SO_2, NO_2, SPM, toxic metals and so on. All this is a very significant development, but what is needed most in this part of the world is the creation of a general awareness among the people that the unfettered exploitation of Nature, whether by technological or other means (for example, the population explosion), has brought to us the threat of disaster.

At the risk of being called the prophets of doom, specialists in environmental science must give the people an emphatic and convincing forewarning of the approach of a calamitous disaster. A thorough education with regard to one's responsibility towards environmental protection should be imparted to individuals and communities alike. Practical and meaningful environmental safety rules should be formed and strictly implemented. Needless to add that the implementation part is at the lowest ebb in this region of the world.

PAC Review

Pure and Applied Chemistry (*PAC*) is IUPAC's official journal. It publishes the main invited lectures of symposia sponsored by the Union; the recommendations of its Commissions on nomenclature, symbols and units, and technical reports on standardization, recommended procedures, collaborative studies and data compilations. Summaries of the most recent IUPAC recommendations on nomenclature and symbols, and technical reports appearing in *PAC* are published in *Chem. Intl.* in the section Recent Reports. In this section we take a brief look at the symposia and lectures published in recent issues of *PAC*.

Calorimetry and thermodynamics of biological processes

The first formal ISBC conference arranged by the International Society for Biological Calorimetry (ISBC) was actually the 8th meeting in a series following the 7th ISMAB – International Symposia on Microcalorimetric Applications in Biology. It was decided to celebrate the 2nd anniversary of the Society's birth by organizing a meeting which not only would cover in a broad sense the different fields within biocalorimetry, but include contributions from inter-related areas. The intention was to stimulate an exchange of ideas in the field of energetics and regulation of bioprocesses alongside the presentation of recent biocalorimetric and biothermodynamic advances.

The conference was organized under the heading 'Calorimetric and thermodynamics of biological processes' and held in Göteborg-Gullmarsstrand, Sweden, on 15–19 May 1992. There were four subsections:

- Growth energetics – energy budgets and efficiency - thermodynamic concepts on biological energy transformations.
- Biotechnology – instrumentation and data analysis.
- Molecular interactions – binding studies of enzymes, antibodies, other biomolecules and molecule-membrane interactions.
- Cellular and organismic energetics – physiological, ecological, pharmacological and toxicological aspects.

Brigitte Zentgraf (Leipzig, Germany) presented a paper on 'Calorimetry studies for optimization of high-performance reactors' at the Symposium on Calorimetry and Thermodynamics of Biological Processes. She is a member of the IUPAC Steering Committee on Biophysical Chemistry.

The contributions to the September 1993 issue of *Pure Appl. Chem.* were ordered according to the structure of the different subsections of the meeting. All the contributions were intended to stimulate interdisciplinary discussions in the continuously growing field of experimental and theoretical bioenergetics.

During the opening ceremony, a medal lecture was presented in the name of the French scientist Lavoisier who, over 200 years ago, first demonstrated the physicochemical basis of physiology by showing that respiration of animals is the simple combustion of carbonaceous food. With Laplace, he used an ice calorimeter to quantify the heat dissipated per unit CO_2. Following this tradition, the lecturer – Richard B. Kemp (University College of Wales, Aberystwyth, UK) – reviewed developments in the calorimetry of animal cells *in vitro* and paid particular attention to the enthalpy balance method for assessing the relative contributions of aerobic and anaerobic pathways to cellular metabolism.

According to the symposium editors, Lena Gustafsson, Richard Kemp and Erich Gnaiger in the preface to this issue of the *Pure Appl. Chem.*, cellular metabolism is not just simple combustion, and the production of heat is rarely the main significance of the oxidation of reduced organic substrates. Metabolism is characterized by two different functions, namely the provision of molecular compounds and the supply of energy for performing various kinds of work. In the absence of work, heat dissipation is quantitatively related to the enthalpy change of metabolic reactions. The dissipated heat, however, is not a general measure of the potential for the metabolic machinery to perform work, which stems from the Gibbs energy change of the metabolic reactions. Inefficiency and dissipation of Gibbs energy contribute to, but are not generally identical with the calorimetric measure of heat dissipation.

Gustafsson, Kemp and Gnaiger add that the measurement of heat dissipation is a fundamental component in the construction of energy budgets of biological systems. In this respect, biological calorimetry is firmly established in the domain of classical thermodynamics. It is equally important however, to recognize that metabolic heat flow is related to irreversible processes in open biological systems. From this perspective, biological calorimetry should be discussed within the framework of nonequilibrium thermodynamics. As such biological calorimetry should become a pivot for uniting concepts of classical and nonequilibrium thermodynamics. This important link is at present entirely missing in the relevant textbooks. The different approaches used in the description and analyses of biological energy transformations have also led to diverse nomenclature and IUPAC recommendations are not available for establishing a concise terminology across the borders between classical and nonequilibrium thermodynamics.

This problem was addressed at a round table discussion during the conference and is dealt with in a contribution to this issue of the journal by Erich Gnaiger (University Hospital of

Innsbruck, Austria). His paper on 'Nonequilibrium thermodynamics of energy transformations' discusses concepts and terminology in the interdisciplinary field of classical and nonequilibrium thermodynamics.

The multidisciplinary contributions published in this issue of *Pure Appl. Chem.* should, say the editors, provide an incentive for important further developments on the consistent description of the structure and dynamics of biological systems.

Surface chemistry, adsorption and chromatography

The IUPAC-sponsored 2nd International Symposium on Surface Chemistry, Adsorption and Chromatography (SCAC'92) took place in Moscow, Russia, on 29 June – 3 July 1992. It was organized by the Scientific Council on Chromatography and Scientific Council on Adsorption of the Russian Academy of Sciences (RAS); Institute of Physical Chemistry, RAS; and Ekonova, Elsiko, Ampersend, Lenkhrom firms.

About 150 scientists from 15 countries attended the symposium. Leading scientists in the fields of adsorption and chromatography presented 34 lectures. The texts of 22 of these lectures were included in the October 1994 issue of *Pure and Applied Chemistry.* Besides lectures, scientists from different countries presented about 100 posters which will be published in the *Russian Journal of Physical Chemistry.*

The following subjects were covered at the symposium:

1. General aspects of adsorption and surface chemistry
2. Structure and properties of sorbents for chromatography
3. Physicochemical aspects of chromatography
4. Chromatography in physicochemical investigations.

Chromatography

New and important theoretical and experimental studies in the fields of surface chemistry, adsorption and chromatography were presented at the symposium. Adsorption phenomena forms the basis of adsorption chromatography which is of considerable importance in preparative separations. Chromatography in its turn permits rapid and very sensitive methods of investigation of adsorbents and adsorption processes.

Symposium editor O. G. Larionov and L. D. Belyakova (Institute of Physical Chemistry of the Russian Academy of Sciences, Moscow) – respectively chairman and learned secretary of the national organizing committee of the symposium, were two of the six co-authors of a paper on 'Chromatographic methods in solid surface investigations' presented at the symposium. The paper considered the application of chromatography as a testing method for properties of surfaces. The authors provided examples of using chromatography to study the geometry and surface chemistry of solids and sorbents of various types, such as nonporous silica, nonporous ionic adsorbents on barium sulfate base, porous γ-iron oxide and polymer sorbents. The high sensitivity of the chromatographic method in investigating the changes in the texture and the chemical state of the surface was shown.

N. A. Katsanos (University of Patras, Greece) presented a paper on 'Studies of diffusion and other rate processes by gas chromatography'. Katsanos reviewed physicochemical measurements by gas chromatography and introduced the carrier gas flow-rate perturbation for the stopped-flow and the reversed-flow techniques. The lecture covered the general principles of the latter and then presented the latest theoretical developments and applications for measurement of rate coefficients and distribution constants. These include gas diffusion coefficients, obstructive factors and external porosites in solid beds, diffusion coefficients of gases in liquids, interfacial gas-liquid resistances to mass transfer, and the simultaneous determination of adsorption, desorption and reaction rate constants of gases on solids.

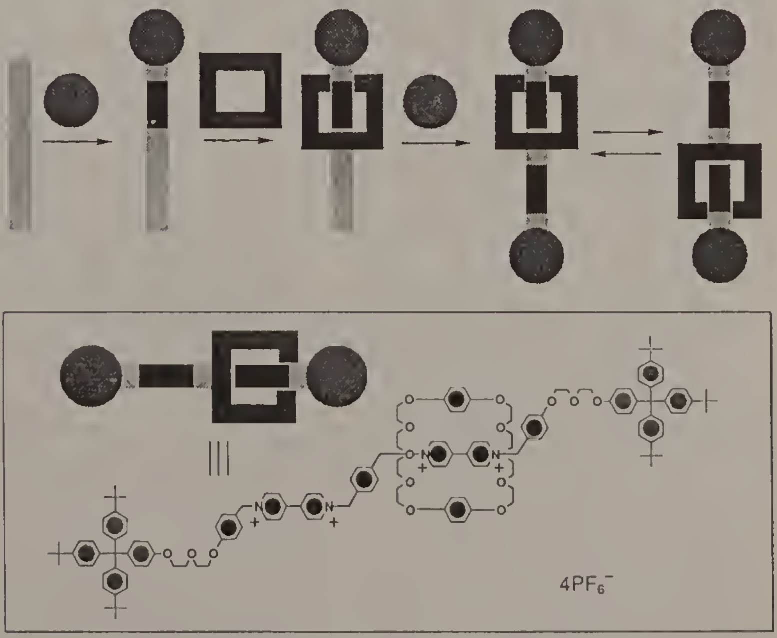
Self-assembly and macromolecular design

Many of the most impressive discoveries and inventions of this century in molecular science have drawn their inspiration from disciplines outside chemistry, as well as from disciples who were not chemists, according to David B. Amabilino and J. Fraser Stoddart (University of Birmingham, UK) in the introduction to their paper on 'Self-assembly and macromolecular design' presented at the 18th International Symposium on Macrocyclic Chemistry (Enschede, Netherlands, 27 June – 2 July 1993). The paper was one of the seven plenary lectures published in the November 1993 issue of *Pure Appl. Chem.*

As an example of such discoveries and inventions, Amabilino and Fraser Stoddart quote the double helix which was a form in art and geometry long before it was revealed in the superstructure of the much venerated DNA molecule. Similarly, knots and dendrimers were contemplated by artists and mathematicians prior to these structures' chemical fruition.

They add that supramolecular chemistry – the chemistry of the noncovalent bond – is practised and exemplified by biochemical systems. Indeed, the biological world has provided supramolecular chemistry with a gamut of functions and processes which take place, often cooperatively, when complementary molecules interact and react under appropriate conditions.

The awe-inspiring efficiency of natural systems alerts us, say the two authors, to the fact that the concepts of self-organization, self-assembly and self-replication are necessary to tame the chemical synthesis of large, well-defined and functioning molecular structures and superstructures.



'Intelligent' self-assembly of a [2]rotaxane.

Progress has recently been made towards self-assembling ordered macromolecular architectures reminiscent of tobacco mosaic virus.

In our everyday world, we can marvel at the tremendous physical stability of cables, ropes, knots and chains. This reality poses an intriguing question to the chemist – can we reproduce the features of mechanical entanglement at the molecular level, and if so, what are the consequences in terms of the properties and functions of the materials?

Many examples of mechanical entanglement in relatively small synthetic chemical systems have already been demonstrated. Catenanes and rotaxanes were first isolated in meagre amounts using statistical synthetic approaches. Self-assembly processes have revolutionized the construction of these interlocked molecules, and have made possible the preparation of the knots and helices by template-directed methods. The formation of these entangled molecules and supermolecules has now been achieved with remarkable efficiency, even although the precise nature of the self-assembly mechanisms has yet to be expounded fully.

Few examples, however, of the related polymeric systems of macromolecular dimensions have been reported. Polyrotaxanes have been described, but their structures are rather ill defined. The next generation of macromolecules will exploit the synthetic methodology of catenane, rotaxane, knot and helix formation for controlled polymer self-assembly. They will be made just as much for their functional, as for their structural properties.

Can chemists reproduce the mechanical entanglement of cables, ropes, knots and chains at the molecular level?

Recent Reports

The international harmonized protocol for the proficiency testing of (chemical) analytical laboratories (Technical Report)

The international standardising organisations AOAC International (then the Association of Official Analytical Chemists), ISO and IUPAC have co-operated to produce an agreed protocol on the 'Design, Conduct and Interpretation of Collaborative Studies'. The Working Group which produced the protocol met and agreed at its April 1989 Washington DC meeting to develop a further protocol on proficiency testing, i.e. consideration of the use of results generated in interlaboratory test comparisons for the purpose of a continuing assessment of the technical competence of a continuing assessment of the technical competence of participating testing laboratories.

Such a harmonised protocol would have to outline the minimum requirements for agencies (laboratories or other organisations) who wished to develop and operated proficiency testing schemes and recommend statistical treatment of the reported data.

A draft harmonised protocol for the organisation of proficiency testing schemes was prepared and discussed at the AOAC International/ISO/IUPAC Meeting on the 'Harmonisation of Quality Assurance Systems in Chemical Analysis', Geneva, May 1991, as part of the development process of such a protocol, and finalised at a meeting of the Working Party in Delft, The Netherlands, May 1992.

This report resulted from the Symposium on Harmonization of Quality Assurance Systems in Chemical Analysis, Geneva, Switzerland, May 1991 held under the sponsorship of IUPAC, ISO and AOAC. It was prepared for publication by Michael Thompson and Roger Wood, Interdivisional Working Party For Harmonization of Quality Assurance Schemes for Analytical Laboratories, Analytical, Applied, Clinical, Inorganic and Physical Chemistry Divisions, and published in Pure Appl. Chem, ***65**, 2123–2144 (1993).*

Nomenclature of kinetic methods of analysis (IUPAC Recommendations 1993)

This report lists, in alphabetical order, names and definitions of those terms, which are most frequently used in kinetic methods of analysis. These include kinetic, differential-kinetic, catalytic and enzymatic terms. The terms have been harmonized with a number of existing IUPAC documents.

This report was prepared for publication by G. Svehla, Commission on Analytical Nomenclature, Analytical Chemistry Division, and published in Pure Appl. Chem, ***65**, 2291–2298 (1993).*

Use of isolated cells to study the metabolism of agrochemicals in animals (Technical Report)

Isolated cells derived from various organs of animals can be used to obtain a variety of information on the metabolism of agrochemicals and xenobiotics in intact animals. Isolated cells catalyze various phase I and II reactions and generally more closely mimic intact animal systems than do other *in* *vitro* systems. However the utility of isolated cells is limited by technical difficulties including isolation techniques, preincubation times, separation of heterogeneous cells and the difficulty in maintaining catalytic activity for a long period of time. Thus, improved techniques for isolating cells and for maintaining the viability of isolated cells are needed. Studies on the relationship between results obtained with isolated cells and with intact animals, and results obtained with animal cells and human cells are also required. Studies with cells containing expressed human enzymes are desirable.

This report is No. 30 in the series of IUPAC Reports on Pesticides. It was prepared for publication by N. Kurihara, G. D. Paulson, S. Otto, J. Miyamoto and R. M. Hollingworth, Commission on Agrochemicals, Applied Chemistry Division, and published in Pure Appl. Chem, ***65****, 2299–2312 (1993).*

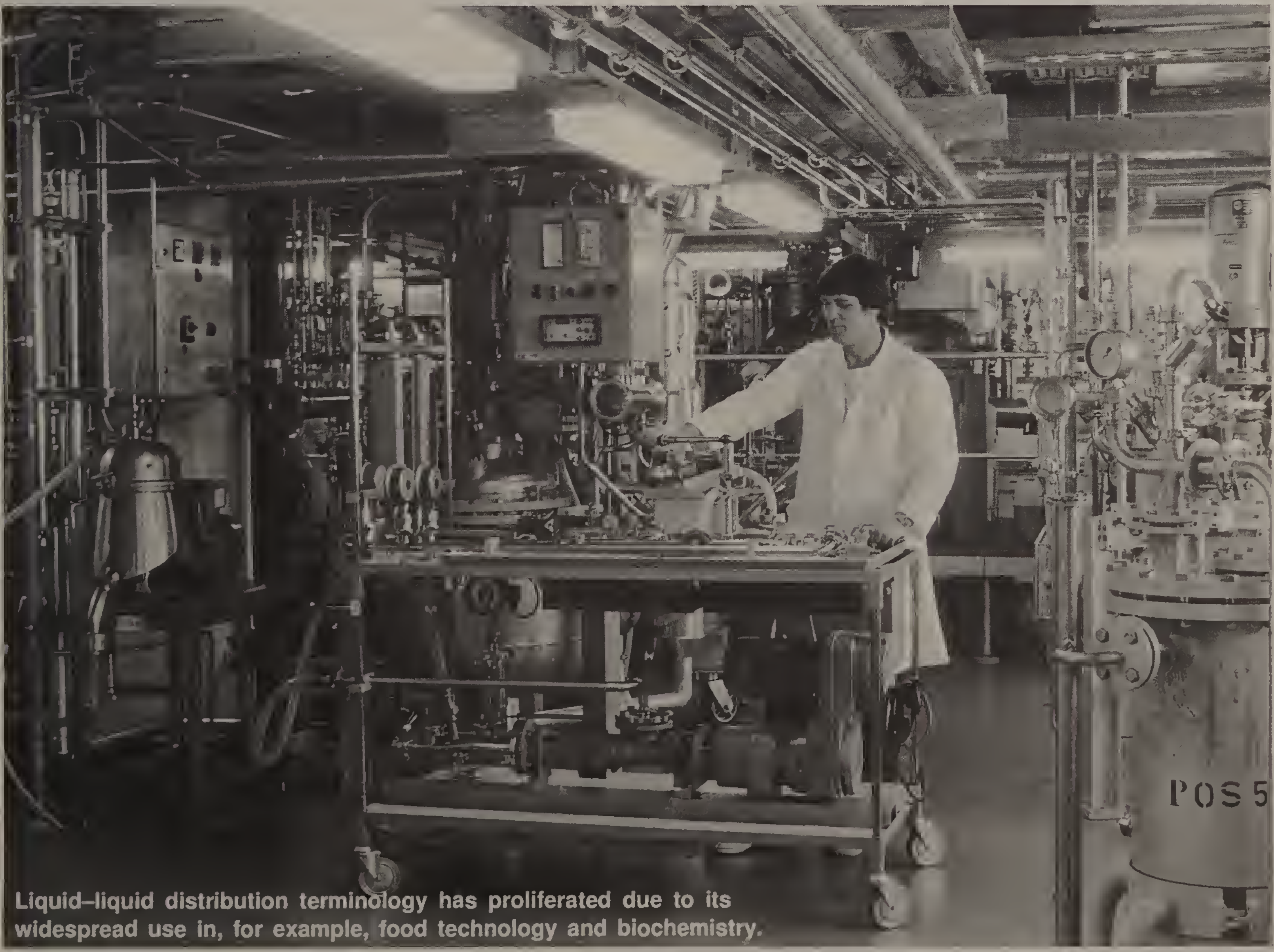
Depth of origin of sputtered atoms (Technical Report)

Spluttering, the ejection of target material following bombardment by energetic ions, is an extremely important technological process. Sputtering is a particularly important technique for the surface analyst, since it is used for both quantitative analysis of impurity concentrations and determination of depth distributions of impurities. Because of the complexity of sputtering, many of its fundamental parameters are difficult to ascertain. The depth of origin of sputtered atoms is a fundamental parameter of the sputtering process which, until recently, has been the subject of considerable controversy. Fortunately, both experiments and theory have improved greatly in this area, allowing a consensus to be reached on this important parameter. This report describes and evaluates these critical experiments and theories.

This report was prepared for publication by M. J. Pellin and J. W. Burnett, Commission on Microchemical Techniques and Trace Analysis, Analytical Chemistry Division, and published in Pure Appl. Chem, ***65****, 2361–2372 (1993).*

Nomenclature for liquid–liquid distribution (solvent extraction) (IUPAC Recommendations 1993)

The widespread use of liquid–liquid distribution, ranging from an analytical chemical technique to a unit operation in various fields of chemical technology (e.g. petroleum refining, nuclear fuel reprocessing, hydrometallurgy, food technology, biochemistry) has led to a proliferation of terminology. This paper extends the scope of the definitions beyond those previously recommended [*Pure Appl. Chem.*, **21**, 111–113 (1970)] and a list of terms, including those previously published, is presented under the following general headings: general definitions of phenomena, operations and relationships; components of the solvent phase; fundamental parameters for quantitative description of liquid–liquid distribution systems; process terminology applicable to large scale continuous operations.



Liquid–liquid distribution terminology has proliferated due to its widespread use in, for example, food technology and biochemistry.

This report was prepared for publication by N. M. Rice and H. M. N. H. Irving (1980) and M. A. Leonard (1987), Commission on Chromatography and other Analytical Separations and Commission on Analytical Nomenclature, Analytical Chemistry Division, and published in Pure Appl. Chem, ***65**, 2373–2396 (1993).*

Nomenclature for supercritical fluid chromatography and extraction (IUPAC Recommendations 1993)

This report presents definitions for the terms and symbols used when supercritical fluids are employed as the liquid phase in chromatography and allied areas including sample extraction. The terms supplement those in the general Nomenclature for Chromatography. The report also includes additional more specific terms.

This report was prepared for publication by Roger Smith, Commission on Chromatography and other Analytical Separations, Analytical Chemistry Division, and published in Pure Appl. Chem, ***65**, 2397–2403 (1993).*

Nomenclature and terminology for analytical pyrolysis (IUPAC Recommendations 1993)

This paper defines terms and definitions used in analytical methods of pyrolysis and includes expressions for coupled systems and for the description of the temperature profiles and the products that are obtained.

Thermal degradation under controlled conditions is often used an part of an analytical procedure, either to render a sample into a suitable form for subsequent analysis by gas chromatography, mass spectrometry or infrared spectroscopy or by direct monitoring as a analytical technique in its own right. A range of terms and expressions have been used in the field and this nomenclature brings these together in a systematic manner and assigns each a specific meaning.

This report was prepared for publication by Peter C. Uden, Commission on Chromatography and other Analytical Separations, Analytical Chemistry Division, and published in Pure Appl. Chem, ***65**, 2405–2409 (1993).*

Provisional Recommendations

IUPAC seeks your comments

In this section we publish synopses of IUPAC's latest provisional recommendations on nomenclature and symbols. All comments on these recommendations are welcome and will be taken into consideration. The final revised versions are published in *Pure and Applied Chemistry* and synopses of these are published in *Chem. Intl.* as recent reports.

If you would like to comment on the Provisional Recommendations please write to your nearest national/regional centre requesting a copy of the full report. Copies are not available from the IUPAC Secretariat. The most up-to-date list of the national/regional centres appeared in *Chem. Intl.* **15**, 209 (1993).

Units for use in atmospheric chemistry

This document examines the utility and suitability of the International System of Units (Système International, SI) as a framework for units in atmospheric chemistry and presents recommendations regarding use of these units in reporting atmospheric chemistry data consistent with the special requirements of this subdiscipline. In general SI is well suited for application to atmospheric chemistry; specifically the wide range of magnitudes that are encountered can be dealt with by the prefixes denoting multiples and submultiples of units, and the application of SI units leads automatically to consistency in unit calculus. Use of named quantities for units that are not products or quotients of SI base units (e.g. atmosphere, Dobson, litre, hectare, bar) is discouraged. Local abundances of substances in air may be expresses as mixing ratios or concentrations. Mixing ratio has the advantage of being independent of pressure or temperature, but concentration has advantages for reaction kinetics and material fluxes. Molar or molecular units for mixing ratios or concentrations of substances of known chemical composition are preferable to mass-based units. The dimensionless unit mol per mol of air is recommended for mixing ratio of a substance in air, e.g. nmol/mol(air), rather than the customary parts per billion (ppb). It is necessary to specify whether a mixing ratio refers to dry or moist air. Expressing mixing ratios as 'reduced concentrations' relative to standard conditions of pressure and temperature leads to ambiguity and should be avoided where possible. Gas-phase concentrations may be expressed either on a molar basis (mol m^{-3}) or molecular basis (molecule m^{-3}, molecule cm^{-3}). The universal use of a single set of units for gas-phase concentrations does not seem forthcoming in the immediate future, although the use of m^{-3} affords advantages of consistency and convenience. An extensive table of recommended symbols and SI units for quantities in atmospheric chemistry is presented.

Comments on the document are welcome and should be sent by 30 September 1994 to: Dr Peter Warneck, Abteilung Biogeochemie, Max-Planck-Institut für Chemie, Postfach 3060, D–55020 Mainz, Germany.

National Centre in Czech Republic

The address of the national centre for distribution of provisional recommendations in the Czech Republic is:

Dr Jaroslav Kahovec, Institute of Macromolecular Chemistry Academy of Sciences of the Czech Republic, Heyrovsky Sq. 2, 162 06 Prague 6, Czech Republic. Tel. +42 (2) 360341; Fax: +42 (2) 367981; E-mail: KAH@IMC.CAS.CS

Publications

Organic chemistry: Its language and its state of the art

'We take for granted that a half kilogram of cheese or 0.2 litres of wine or a 10 kilometre run is the same weight or volume or distance wherever we are. Through nearly all of the eighteenth century, however, weights and measures were not uniform but depended on a locality. Among the cities of France, for example, the actual length of a meter varied by 6%. In 1790, in spite the distraction of social and political turmoil generated by the French Revolution, the Paris Academy of Sciences appointed a committee to work toward a solution to the problem. The committee's recommendations led to standardization of weights and measures in France in 1799, and the standards spread throughout Europe. Refinements and extensions in the specifications of the standards have been adopted from time to time, but, once the standards were established, few respectable users of weights and measures persisted in using the older, nonstandard measures seriously.

'A century later a similar problem and a similar but less successful solution marked organic chemical nomenclature. Standards of nomenclature set by an international commission of eminent chemists meeting in Geneva in April 1892 quickly received substantial support and use but not among all users of nomenclature. Articulate challenges to the rules adopted by the commission were expressed, some by members of the commission itself. Yet, in spite of the subsequent revision, extension, and even withering of some of those first rules, the Geneva Conference had a profound influence on chemical nomenclature and its users. It is truly worthy of a centennial celebration.'

So writes James G. Traynham (Lousiana State University, USA) in the opening of his paper on 'Organic Nomenclature: The Geneva Conference 1892 and the Following Fifty Years'. This is the first of 15 invited lectures presented at the 1992 Commemorative Symposium on the Centennial Anniversary of the 'Geneva Conference' – the first International Conference on Organic Chemical Nomenclature [see *Chem. Intl.* **15**, 7–10, (1993)]. The papers are published in the volume *Organic Chemistry: Its Language and Its State of the Art* edited by Dr M. Volkan Kisakürek and published by VCH.

In the Preface to the volume, Kisakürek writes 'Born out of the recognition across national boundaries that parochial chemical nomenclature ill-served the needs of the chemical community for unambiguous communications, that first International Meeting laid the foundations for systematic organic chemical nomenclature, in other words, for an internationally needed and acceptable 'language' of chemistry.'

Kisakürek points out that the 1892 Geneva Conference included as participants the most eminent chemists of the period, for example, Friedel, E. Fischer, A. v. Baeyer, Cannizzaro, Paternò, and Hantzsch, more so than subsequent meetings on 'nomenclature matters'. Today's 'modern' organic chemist enjoys rapid discovery (the number of new compounds has reached proportions unimaginable one hundred years ago) but tends to neglect the urgent need for the language in capturing the newly acquired information. Figure 1 shows the explosive growth in known compounds over the century 1892–1992. It is taken from the paper on 'The Importance of Language in the Teaching of Organic Chemistry' by Marjorie C. Caserio (University of California, USA).

Figure 2 is one of numerous examples of organic chemical nomenclature presented in this book. It provides a comparison of trivial and systematic names and is taken from the paper on 'Organic Nomenclature: The Geneva Conference and the Second Fifty Years: Some Personal Observations' by Kurt L. Loening (Topterm, Columbus, Ohio, USA) who was for several years Chairman of IUPAC's Interdivisional Committee on Nomenclature and Symbols (IDCNS).

Fig. 3 (Clockwise from left): Centre of Geneva; Jean-Marie Lehn; Vladimir Prelog; Université de Genève, Uni Dufour, venue of the Commemorative Symposium.

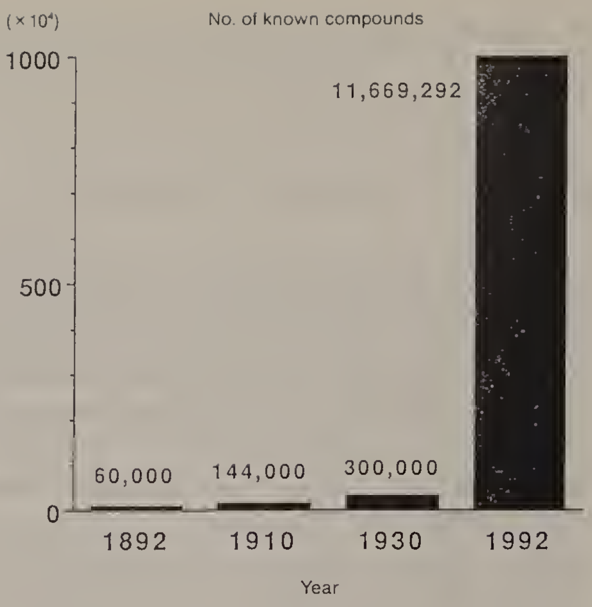
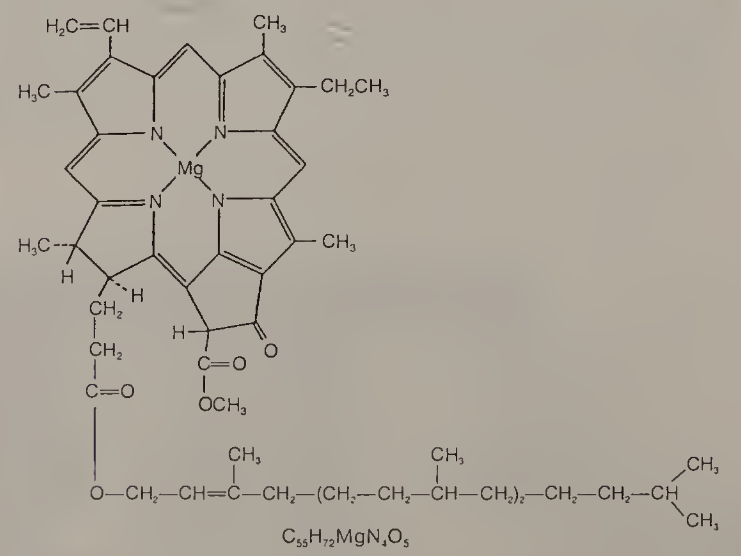


Fig. 1 Growth in known compounds in the last century.

Some of the papers, such as "My `Nomenclature Years'" by Nobel Prize Winner Vladimir Prelog (ETH-Zentrum, Zürich, Switzerland) and `Tomorrow's Organic Nomenclature' by Jack H. Stocker (University of New Orleans, USA) are full of humorous anecdotes. Figure 3 shows a cartoon from Kisakürek's paper on `Chemistry Journals and Nomenclature, 1892–1930'.

The following is a full list of the contents of this book:

- Organic Nomenclature: The Geneva Conference 1892 and the Following Fifty Years (James G. Traynham, Louisiana State University, USA).
- Forty Years of Ferrocene (Jack D. Dunitz, ETH-Zentrum, Zürich, Switzerland).
- Synthesis of New Heterocyclic Systems by Photochemical Reactions of Chromium Carbene Complexes with Imidazolines (Claudia Betschart and Louis Hegedus, Colorado State University, USA).
- Organic Nomenclature: The Geneva Conference and the Second Fifty Years: Some Personal Observations (Kurt L. Loening, Topterm, Columbus, Ohio, USA).
- My 'Nomenclature Years' (Vladimir Prelog, ETH-Zentrum, Zürich, Switzerland).


$H_2C{=}CH$
CH_3
H_3C
CH_2CH_3
N
Mg
CH_3
H
CH_2
$C{=}O$
O
OCH_3
$O{-}CH_2{-}CH{=}C(CH_3){-}CH_2{-}(CH_2{-}CH_2{-}CH(CH_3){-}CH_2)_2{-}CH_2{-}CH_2{-}CH(CH_3)_2$
$C_{55}H_{72}MgN_4O_5$

Trivial Name: 12 characters

Chlorophyll a

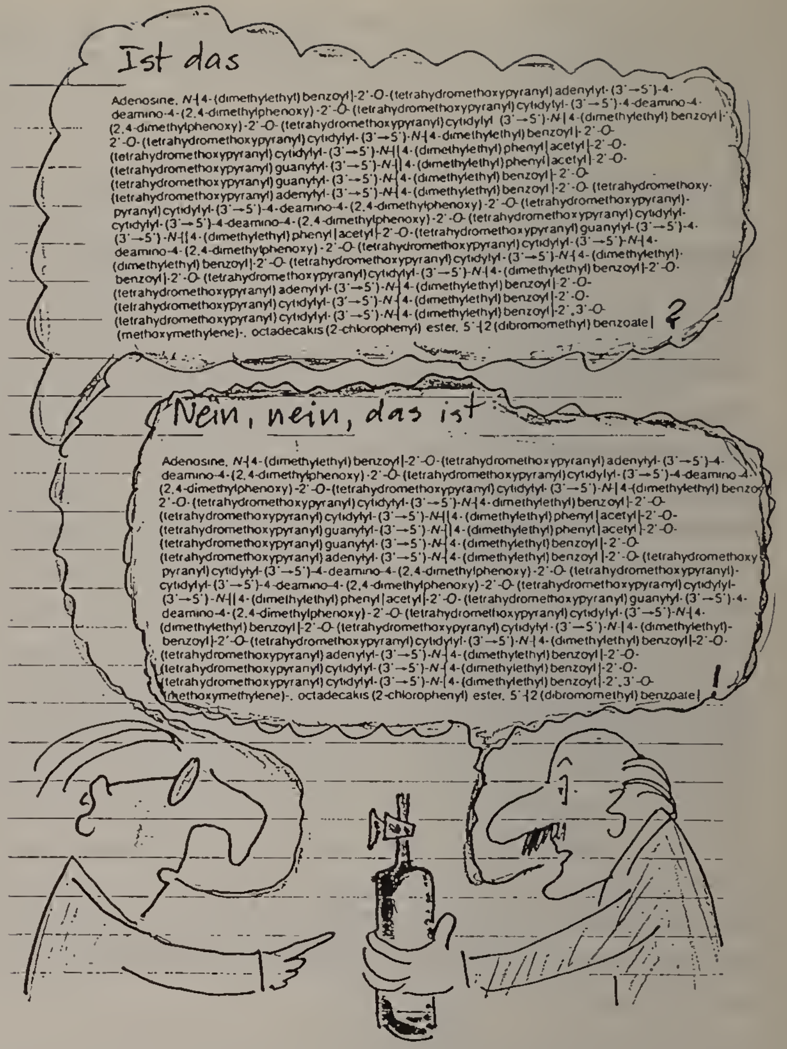
IUPAC Name. 129 characters

(*E*)-[Dihydrogen 21-carboxy-14-ethyl-4,8,13,18-tetramethyl-20-oxo-9-vinyl-3-phorbinepropionato(2-)]-magnesium, 21-methyl 3-phytyl ester

Current Chemical Abstracts Index Name: 203 characters

[*SP*-4-2-[3*S*-[3α(2*E*,7*S**,11*S**),4β,21β]]]-[3,7,11,15-Tetramethyl-2-hexadecenyl 9-ethenyl-14-ethyl-21-(methoxycarbonyl)-4,8,13,18-tetramethyl-20-oxo-3-phorbinepropanoato(2-)-N^{23},N^{24},N^{25},N^{26}]magnesium

Fig. 2 Comparison of length of trivial names vs. systematic names.


Ist das
Adenosine, N-[4-(dimethylethyl)benzoyl]-2′-O-(tetrahydromethoxypyranyl)adenylyl-(3′→5′)-4-deamino-4-(2,4-dimethylphenoxy)-2′-O-(tetrahydromethoxypyranyl)cytidylyl-(3′→5′)-4-deamino-4-(2,4-dimethylphenoxy)-2′-O-(tetrahydromethoxypyranyl)cytidylyl-(3′→5′)-N-[4-(dimethylethyl)benzoyl]-2′-O-(tetrahydromethoxypyranyl)cytidylyl-(3′→5′)-N-[4-dimethylethyl)benzoyl]-2′-O-(tetrahydromethoxypyranyl)cytidylyl-(3′→5′)-N-[[4-(dimethylethyl)phenyl]acetyl]-2′-O-(tetrahydromethoxypyranyl)guanylyl-(3′→5′)-N-[[4-(dimethylethyl)phenyl]acetyl]-2′-O-(tetrahydromethoxypyranyl)guanylyl-(3′→5′)-N-[4-(dimethylethyl)benzoyl]-2′-O-(tetrahydromethoxypyranyl)adenylyl-(3′→5′)-N-[4-(dimethylethyl)benzoyl]-2′-O-(tetrahydromethoxypyranyl)cytidylyl-(3′→5′)-4-deamino-4-(2,4-dimethylphenoxy)-2′-O-(tetrahydromethoxypyranyl)cytidylyl-(3′→5′)-4-deamino-4-(2,4-dimethylphenoxy)-2′-O-(tetrahydromethoxypyranyl)cytidylyl-(3′→5′)-N-[[4-(dimethylethyl)phenyl]acetyl]-2′-O-(tetrahydromethoxypyranyl)guanylyl-(3′→5′)-4-deamino-4-(2,4-dimethylphenoxy)-2′-O-(tetrahydromethoxypyranyl)cytidylyl-(3′→5′)-N-[4-(dimethylethyl)benzoyl]-2′-O-(tetrahydromethoxypyranyl)cytidylyl-(3′→5′)-N-[4-(dimethylethyl)benzoyl]-2′-O-(tetrahydromethoxypyranyl)cytidylyl-(3′→5′)-N-[4-(dimethylethyl)benzoyl]-2′-O-(tetrahydromethoxypyranyl)adenylyl-(3′→5′)-N-[4-(dimethylethyl)benzoyl]-2′-O-(tetrahydromethoxypyranyl)cytidylyl-(3′→5′)-N-[4-(dimethylethyl)benzoyl]-2′-O-(tetrahydromethoxypyranyl)cytidylyl-(3′→5′)-N-[4-(dimethylethyl)benzoyl]-2′,3′-O-(methoxymethylene)-, octadecakis(2-chlorophenyl) ester, 5′-[2(dibromomethyl)benzoate]
?
Nein, nein, das ist
Adenosine, N-[4-(dimethylethyl)benzoyl]-2′-O-(tetrahydromethoxypyranyl)adenylyl-(3′→5′)-4-deamino-4-(2,4-dimethylphenoxy)-2′-O-(tetrahydromethoxypyranyl)cytidylyl-(3′→5′)-4-deamino-4-(2,4-dimethylphenoxy)-2′-O-(tetrahydromethoxypyranyl)cytidylyl-(3′→5′)-N-[4-(dimethylethyl)benzoyl]-2′-O-(tetrahydromethoxypyranyl)cytidylyl-(3′→5′)-N-[4-dimethylethyl)benzoyl]-2′-O-(tetrahydromethoxypyranyl)cytidylyl-(3′→5′)-N-[[4-(dimethylethyl)phenyl]acetyl]-2′-O-(tetrahydromethoxypyranyl)guanylyl-(3′→5′)-N-[[4-(dimethylethyl)phenyl]acetyl]-2′-O-(tetrahydromethoxypyranyl)guanylyl-(3′→5′)-N-[4-(dimethylethyl)benzoyl]-2′-O-(tetrahydromethoxypyranyl)adenylyl-(3′→5′)-N-[4-(dimethylethyl)benzoyl]-2′-O-(tetrahydromethoxypyranyl)cytidylyl-(3′→5′)-4-deamino-4-(2,4-dimethylphenoxy)-2′-O-(tetrahydromethoxypyranyl)cytidylyl-(3′→5′)-4-deamino-4-(2,4-dimethylphenoxy)-2′-O-(tetrahydromethoxypyranyl)cytidylyl-(3′→5′)-N-[[4-(dimethylethyl)phenyl]acetyl]-2′-O-(tetrahydromethoxypyranyl)guanylyl-(3′→5′)-4-deamino-4-(2,4-dimethylphenoxy)-2′-O-(tetrahydromethoxypyranyl)cytidylyl-(3′→5′)-N-[4-(dimethylethyl)benzoyl]-2′-O-(tetrahydromethoxypyranyl)cytidylyl-(3′→5′)-N-[4-(dimethylethyl)benzoyl]-2′-O-(tetrahydromethoxypyranyl)cytidylyl-(3′→5′)-N-[4-(dimethylethyl)benzoyl]-2′-O-(tetrahydromethoxypyranyl)adenylyl-(3′→5′)-N-[4-(dimethylethyl)benzoyl]-2′-O-(tetrahydromethoxypyranyl)cytidylyl-(3′→5′)-N-[4-(dimethylethyl)benzoyl]-2′-O-(tetrahydromethoxypyranyl)cytidylyl-(3′→5′)-N-[4-(dimethylethyl)benzoyl]-2′,3′-O-(methoxymethylene)-, octadecakis(2-chlorophenyl) ester, 5′-[2(dibromomethyl)benzoate]
!

- Chemistry Journals and Nomenclature, 1892–1930 (M. Volkan Kisakürek, University of Zürich-Irchel, Switzerland).
- The Concepts and Language of Supramolecular Chemistry (Jean-Marie Lehn, Université Louis Pasteur, Strasbourg, France).
- The Importance of Language in the Teaching of Organic Chemistry (Marjorie C. Caserio, University of California, USA).
- Synthetic Progress toward Powerfully Cytotoxic Taxol and Related Taxane Diterpenes (Leo A. Paquette, The Ohio State University, USA).
- Chemical Nomenclature in the Government Laboratory (Edward W. Godly, Laboratory of the Government Chemist, London, UK).
- Organic Chemistry in Lithium Perchlorate/Diethyl Ether (Paul A. Grieco, Indiana University, USA).
- Recent Progress in Asymmetric Synthesis (Wolfgang Oppolzer, Université de Genève, Switzerland).
- Tomorrow's Organic Nomenclature (Jack H. Stocker, University of New Orleans, USA).
- The History of Chemical Substance Nomenclature at *Chemical Abstracts Service* (*CAS*) (Patton M. Giles, Jr and W. V. Metanomski, Chemical Abstracts Service, Columbus Ohio, USA).

Organic Chemistry: Its Language and Its State of the Art *is edited by M. Volkan Kisakürek and published jointly by VHCA, Verlag Helvetica Chimica Acta, Basel (Switzerland), VCH Verlagsgesellschaft mbH, Weinheim (Federal Republic of Germany) and VCH Publishers, Inc., New York, NY (USA), 1993. 196 pp. ISBN 3-527-28490-7 (VCH, Weinheim); 1-56081-256-7 (VCH, New York); 1-906390-03-9 (VHCA). Price: DEM 178.–/CHF 165.–.*

IUPAC Stability Constants Database

What are stability constants?

In solution, metal ions (electron pair acceptors including H^+) can form complexes with ligands (inorganic or organic molecules or ions, able to donate an electron pair). In such a complex, the properties of both the metal ion and the ligand will be modified, often significantly, and this will have far-reaching effects on such properties as reactivity. Stability constants measure the affinity which a metal ion has for a ligand. This allows the user to calculate the states in which the reactants exist (the speciation), and so to predict the resulting properties, including reactivity.

What is the SC-database?

The IUPAC Stability Constants Database, SC-database [see *Chem. Intl.* **15,** 191 (1993) and **16**, 37 (1994)] gives very fast access to all significant data on stability constants in the chemical literature world-wide. Access is also gained to the experimental conditions under which the constants were measured and, in some cases, a critical evaluation of the data. Selected data can either be studied on the screen, or saved to disk (either as raw data or as a mini-database) or output to a printer. The user is able to apply the data to the calculation of species distribution curves (speciation curves) as a function of pH, to provide an immediate illustration of the importance of each species.

Why not use the traditional book form?

Compared with book compilations of data, ease and speed of access will be in a completely different league. The data would extend to many book volumes, each necessitating separate consultation. In addition to very rapid searching, by using the equivalent of cross-referencing about 25 separate indexes, criteria can be applied as groups (for example, all amino acids or all alkali metals) or as the intersection points of different indexes (for example, measurements performed on amines between 1980–83 using a glass electrode and published in *J. Chem. Soc. (Dalton)* – possibly an esoteric profile!). Unlike the fixed display of a page of a book, the selected data can be viewed, individually in full detail or collectively in condensed format, on screen. They can also be printed out in a variety of formats or saved on disk for further study (including later elimination of unwanted data) or as a source of data for other applications.

Who will use the IUPAC Stability Constants Database?

The SC-database will be relevant for anyone whose work involves metal ions in solution, whether the solutions are natural waters (potable water, sea water, sewage etc.), industrial or agricultural effluents, hydrometallurgical solutions, analytical solutions or biological fluids. Major users will therefore include chemists (especially analytical chemists) working in industrial, agricultural, environmental and clinical chemistry and biochemistry, as well as any area of chemical research (academic, industrial or environmental) which handles metal ions in solution. Many workers in these fields are not familiar with the chemical literature or do not have easy access to it, or are not knowledgeable in the precise interpretation of stability constants. In fact, increasing numbers of such workers are not even chemists by background. The database will give them rapid access to the vast mine of information in the literature and assistance in evaluating and using the data.

Examples

The following are examples of problems for which a knowledge of the values of stability constants and the ability to calculate species distribution curves assist in providing answers:

- Various phosphates are common components of agricultural and domestic effluents and, as such, raise environmental concern. How might they interact with common metals such as calcium and magnesium?
- Toxic metal ions (for example, nickel) are present in some industrial waste. They may be in an insoluble form but are they likely to be solubilized in the presence of other waste (for example, sewage)?
- Copper and zinc are present in blood serum. In what state are they held? What effect might there be on their distribution if the total concentrations are changed?

For further information, order form and/or demonstration disk, call or write to: Academic Software, Sourby Data Centre, Timble, Otley, Yorkshire, LS21 2PW., UK. Tel/Fax: +44 (943) 880628.

Water pollution in Venice, Italy. The SC-database will provide data for chemists whose work involves metal ions in natural waters, industrial or agricultural effluents, hydro-metallurgical solutions, analytical solutions or biological fluids. (*Photo: UNESCO/ Dominique Roger.*)

Environmental particles

Volume 2 in the IUPAC Environmental Analytical and Physical Chemistry Series on *Environmental Particles* has recently been published. The editors, Jacques Buffle (University of Geneva, Switzerland) and Herman P. van Leeuwen (Agricultural University, Wageningen, Netherlands) point out that, at the time of preparing Volume 1 of this series [*Chem. Intl.* **14**, 182–185 (1992)], it was already clear that the topic of environmental particles has a very broad scope and impact. They therefore decided to initiate a second volume placing emphasis on spectroscopic and colloidal aspects.

The treatment in the second volume extends from purely analytical aspects of sampling and characterization to the initiation and development of new concepts in the analysis of physicochemical processes and interactions in real environmental systems. The volume comprises 9 chapters on the following topics:

1 Surface Spectroscopy of Environmental Particles by Fourier-Transform Infrared and Nuclear Magnetic Resonance Spectroscopy.
2 Characterization of Biological and Environmental Particles Using Static and Dynamic Light Scattering.
3 Structure, Formation and Reactivity of Hydrous Oxide Particles; Insights From X-ray Absorption Spectroscopy.
4 Use of Field-Flow Fractionation Techniques to Characterize Aquatic Particles, Colloids and Macromolecules.
5 Environmental Aerosol Characterization by Single Particle Analysis Techniques.
6 Sampling and Characterization of Colloids and Particles in Groundwater for Studying Their Role in Contaminant Transport.
7 Manganese Particles in Freshwater.
8 Physicochemical Aggregation and Deposition in Aquatic Environments.
9 Modelling Coagulation of Algae in Marine Ecosystems.

Environmental Particles, *Volume 2 is edited by Jacques Buffle and Herman P. van Leeuwen and published by Lewis Publishers, Michigan, USA, 1993. xii + 426 pp. ISBN* 0-87371-895-X.

World Science Report 1993

In the Preface to UNESCO's recently published *World Science Report 1993,* the Director-General of UNESCO, Federico Mayor, points out that science and technology have played a key role in economic and social development in the century now drawing to a close. They have increasingly shown themselves, in the context of an accelerating growth of basic research and an ever more rapid applications of its results, powerful instruments for the promotion of one of the main goals of the UN Charter – 'social progress and better standards of life in larger freedom'.

Yet the distribution of scientific and technological capacity, and of its fruits, remains very uneven from region to region and from country to country. Over four-fifths of research and development activities are concentrated in just a few industrialized countries. In 1990 expenditure on R&D as a percentage of gross national product was 2.9% for the industrialized world as a whole, whilst many developing countries could barely manage one-tenth of this level. Such figures provide substantial justification for the 'S' in UNESCO's title: one of its tasks is quite simply to help redress this imbalance.

The Director-General adds that development cooperation is however only one aspect of UNESCO's larger function of intellectual cooperation – which is aimed at advancing and spreading knowledge worldwide, particularly in fields where an international approach is proving increasingly indispensable, and at fostering in the process ethical solidarity as a vital adjunct to intellectual exchanges. When, in this context, plans were mounted for the regular publication of a series of global reports on the areas within its competence, UNESCO – the only organization within the United Nations system responsible for cooperation in the sciences *per se* – naturally decided to devote one such report to science and technology in today's world. The UNESCO General Conference, at its 26th session in November 1991, subsequently authorized the preparation and publication of the first *World Science Report.*

The report was planned with the help of an advisory group made up of individuals with a career-long interest in the organization and conduct of science. It is the product many hands. Senior scientists and practised science watchers were invited to give the benefit of their knowledge and experience in matters scientific by contributing individual chapters to the text.

Mayor explains that the first part of the book attempts to give a global status report on science in the world today. Chapters within it are either devoted to complete regions or to countries or groups of countries whose science for one reason or another is at a particularly interesting stage of development. Authors were invited to give a personal appreciation of science in their parts of the world. Some chose to write accounts containing much data on research funding and manpower levels, reflecting the fact that some regions have a wealth of statistical material available on scientific research, training and development; other authors preferred to give more conceptual appraisals.

Part 2 of the report deals with science and technology systems, describing the manner and means by which science is organized and carried out, and showing how indicators of scientific activity can be interpreted to give a global picture of science in the world.

EUR
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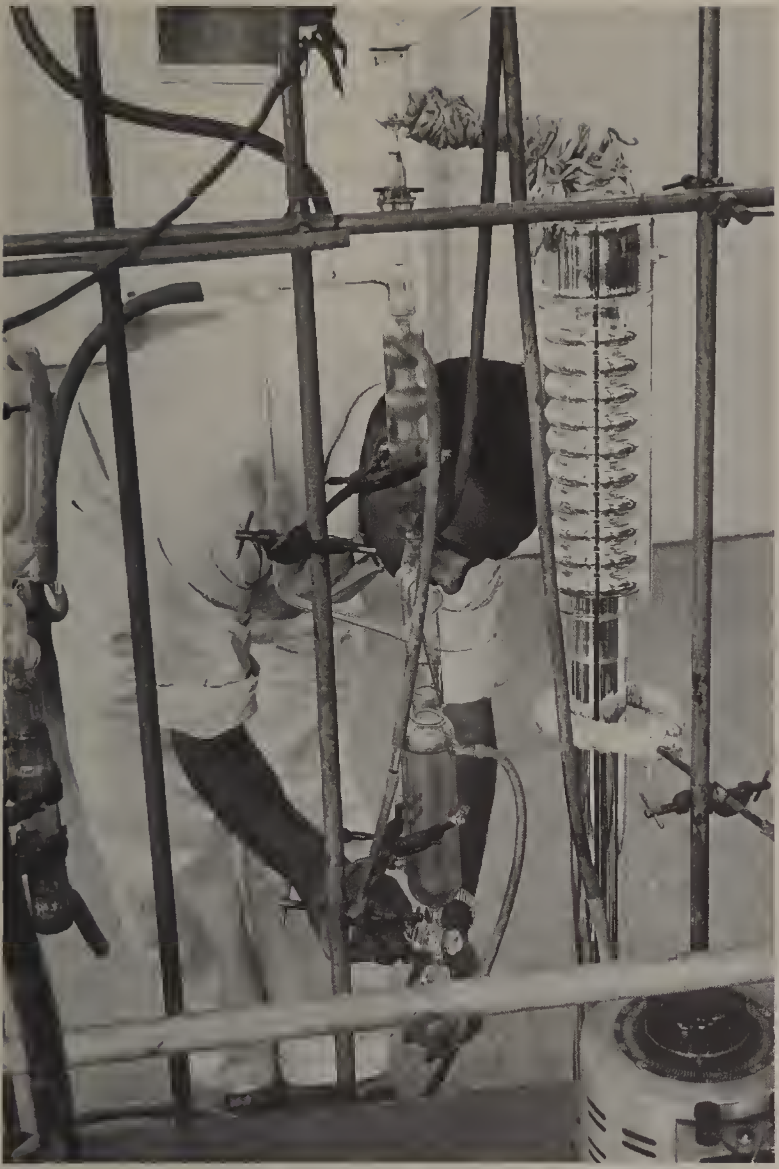
Federico Mayor: 'Ways must be found of ensuring that the decisions of government and industry incorporate the best possible advice of the scientific community'. (*Photo: UNESCO/Dominic Roger.*)



In 1990 expenditure on R&D as a percentage of gross national product was 2.9% for the industrialized world as a whole, whilst many developing countries could barely manage one-tenth of this level. (*Photo UNESCO/M. Serraillier.*)

International cooperation, whether it be at intergovernmental or non-governmental level, is a major feature of science and technology today, stresses Mayor. Many scientific fields require extensive – and often expensive – research, and this can sometimes only be achieved by collective action on the part of governments, institutions or individuals. In Part 3, three exponents of such cooperation describe and discuss the many benefits and successes that have accrued from international partnerships.

The Director-General points out that no book claiming to be an account of the state of science in the world can avoid discussing something of the substance of scientific research. In an attempt to transmit some of the excitement of modern discovery, UNESCO invited four scientists whose work keeps them in touch with developments across their disciplines to each write a readable, non-specialist account of just some of the significant developments in their fields during the course of the last two or three years. These chapters should be of interest to those not necessarily specialized in the respective areas, but wishing for such an overview. The number of subjects that could have been treated in this way was, of course, almost limitless. UNESCO was therefore obliged to be selective and for this first issue it has restricted coverage to the four basic sciences: mathematics, physics, chemistry and biology. In subsequent publications the applied sciences will be reviewed, including the earth and environmental sciences, engineering, and computer and information sciences.

The chapter focusing on developments in chemistry over recent years covers the following topics: chemistry on the atomic scale including the development and applications of devices such as the scanning tunnelling microscope; femtosecond chemistry; new superconducting materials; fullerenes; CFCs and their alternatives; organic synthesis including asymmetric synthesis; and supramolecular chemistry.

The text of the report is complemented by an Appendix containing statistical data on national scientific manpower and expenditure taken from the most recent issue of UNESCO's *Statistical Yearbook*.

Mayor says that the report appears at a time when the need to boost the scientific input to decision-making – all too often based on exclusively economic and political considerations – has never been greater. Ways must be found of ensuring that the decisions of government and industry incorporate the best possible advice of the scientific community. Scientists are also required for other essential development functions, such as selecting, adapting and maintaining imported technology and staffing the new posts (for example, the 'eco-jobs' required to implement Agenda 21) that must be created, particularly at the municipal level, to address some of the major challenges of our time (protection of the environment, rational use of water resources and management of non-renewable energy sources).

The report aims to be of use and interest to a wide audience, including decision- and policy-makers involved in science and technology matters, those researchers and teachers wanting an overview so often lacking, and individual non-specialists simply interested in knowing a little more about the state of science in the world today.

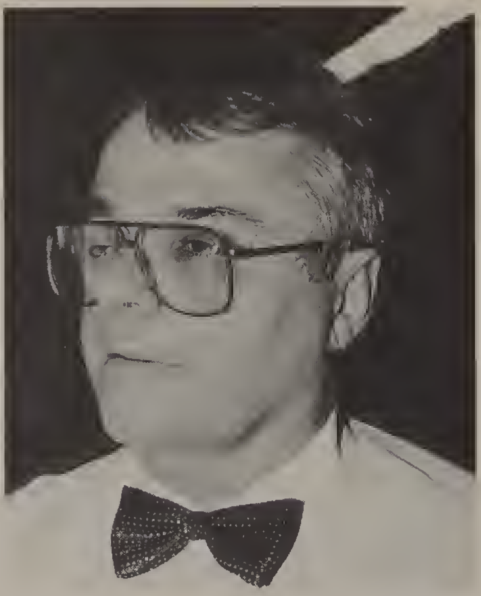
World Science Report 1993 *is published by UNESCO, Paris, France, 1993. 278 pp. ISBN 92–3–102938-X. Price: FRF 150, USD 40.00.*

Ring-opening polymerization

The July 1993 issue of *Die Makromolekulare Chemie: Macromolecular Symposium* (Vol. 73, 1–236) includes the plenary and main lectures delivered at the IUPAC-sponsored Symposium on Ring-Opening Polymerization held in Warsaw, Poland, in July 1992. The content reflects the variety of scientific activities and recent research interests in this field.

A comprehensive review of novel chemistry, important methods of synthesis and novel applications of non-traditional engineering materials and biomedical polymers obtained via ring-opening polymerization is presented. The mechanistic features including non-traditional mechanisms of coordination ring-opening polymerization, anionic ring-opening polymerization and cationic ring-opening polymerization are emphasized.

The symposium editor is Zbigniew Jedliński (Institute of Polymer Chemistry, Polish Academy of Sciences, Zabrze, Poland). Jedliński also contributed a paper on 'Novel chemistry of β-lactones anionic polymerization'.



Jean-Claude Richer.

Parler de chimie en Français

Ottawa, August 1993: The Department of Secretary of State Canada, in collaboration with Canada Communication – Publishing (CCG-P), released the French edition of the IUPAC *Compendium on chemical terminology.* The publication was prepared by Jean-Claude Richer (Department of Chemistry, University of Montreal) who is Secretary of IUPAC's Organic Chemistry Division.

Compendium de terminologie chimique lists, in French, terms used in chemistry, with definitions recommended by various IUPAC commissions dealing with nomenclature and terminology. Terms from physical, inorganic, organic, macromolecular and analytical chemistry are included. The French edition also contains an English–French glossary.

Examples of the information presented in the French compendium include:

CHROMATOGRAPHE (CHROMATOGRAPHIER)	CHROMATOGRAPH

(verbe): séparer par *chromatographie*.
(nom): l'ensemble d'appareils nécessaires pour effectuer une séparation chromatique.

As well as:

ANALYTICAL CALIBRATION CURVES	**COURBE ANALYTIQUE D'ÉTALONNAGE**
HYDROGEN BOND	**LIAISON D'HYDROGENE**
RELATIVE STANDARD DEVIATION	**ÉCART-TYPE RELATIF**

Compendium de terminologie chimique *(catalogue number P60-4/7-1993F), price CAD 59.95, may be ordered from CCG-P, Ottawa, Canada K1A 0S9.*

Data for global change

CODATA is an interdisciplinary Scientific Committee of the Council of Scientific Unions (ICSU) which seeks to improve the quality, reliability, management and accessibility of data of importance to all fields of science and technology. It is concerned with all types of quantitative data resulting from experimental measurements or observations in the physical, biological, geological and astronomical sciences. The general objectives are:

- Improvement of the quality and accessibility of data, as well as the methods by which data are acquired, managed and analysed.
- Facilitation of international cooperation among those collecting, organizing and using data.
- Promotion of an increased awareness in the scientific and technical community of the importance of these activities.

Since 1968, the ICSU Committee on Data for Science and Technology has held an international conference every two years to bring together individuals concerned with these subjects. These conferences have provided an opportunity for those concerned with data in various disciplines of science, as well as specialists in information technology to exchange ideas and report on recent developments. The conferences have formed one of the key mechanisms by which CODATA carries out its mission to improve the quality, reliability, management, and accessibility of data of importance to all fields of science and technology.

The 13th International CODATA Conference was held in Beijing, China, on 19–22 October 1992, and for the first time was held in collaboration with the ICSU Panel on World Data Centers. Approximately 280 scientists from 26 countries attended the conference. Volume 24, Number 4 (October – December 1992) of *CODATA Bulletin* contains selected papers on data of importance to studying global change as well as papers of general interest in the Earth Sciences. The volume is edited by Phillis S. Glaeser (CODATA Executive Secretary) and Stanley Ruttenberg. The full proceedings will appear later.

With this issue, the *CODATA Bulletin* which began publication in October 1969 ceased to exist as a regularly published journal. The CODATA Publications Advisory Board has recommended that reports of active CODATA Task Groups appear as separate monographs.

For further information on CODATA contact: CODATA Secretariat, 51 Boulevard de Montmorency, 75016 Paris, France. Tel: +33 (1) 45 25 04 96. Telex: ICSU 630563 F.

International Newsletter on Chemical Education

In the December 1993 issue (No. 40) of *International Newsletter on Chemical Education* (INCE), Yoshito Takeuchi examines the public image of chemistry in Japan, a theme he developed at the IUPAC-sponsored 12th International Conference on Chemical Education (12th ICCE) which took place in Bangkok, Thailand, in December 1992. Claudio Gebauer looks at the effects of introducing chemistry into the fifth to eighth grade science curriculum in Chile, and Ann Benbow describes FACETS, a modular course developed by the American Chemical Society to teach science to intermediate children in the USA in a cross-curricular fashion.

As Chairman of the Educational Committee of the Institute of Chemistry, Oleap Fernando paints a picture of the chemical education scene in Sri Lanka. Half way round the world, there are many science teachers in the UK with a non-chemistry background who are called upon to teach the chemistry component of the 'balanced science' required by the National Curriculum and are finding it difficult to cope. Mark Atlay describes the Open University's efforts to remedy this situation.

David Kent and Peter Towse report on a partnership established between teacher education and industry which was used as a base for producing resource materials for use in secondary school classrooms in the UK. There are also brief reports on the 12th ICCE and the 5th International Chemistry Conference in Africa.

Peter Towse *Editor, INCE*
C.S.S.M.E., University of Leeds, Leeds LS2 9JT, UK

Gold Book translated into Russian

The *Compendium of Chemical Terminology – IUPAC Recommendations* (the 'Gold Book') compiled by Victor Gold, Kurt L. Loening, Alan D. McNaught, and Pamil Sehmi and published by Blackwell Scientific Publications (Oxford) in 1987, has been translated into Russian. Two volumes are available: an English version with a Russian translation of each term (example A); and a full Russian version with an English translation of each term (example B)

Example A

CHEMICAL REACTION. Химическая реакция.

A process that results in the interconversion of chemical species. Chemical reactions may be elementary reactions or stepwise reactions. (It should be noted that this definition includes experimentally observable interconversions of conformers).

Detectable chemical reactions normally involve sets of molecular entities, as indicated by this definition, but it is often conceptually convenient to use the term also for changes involving single molecular entities (i. e. microscopic chemical events).

See also identity reaction.

1983, 55,1300

Example B

ХИМИЧЕСКАЯ РЕАКЦИЯ. *Chemical reaction.*

Процесс, приводящий к превращению химических соединений. Химические реакции могут быть элементарными или многостадийными. (Следует отметить, что это определение включает экспериментально наблюдаемые взаимные превращения конформеров).

Детектируемые химические реакции обычно включают наборы молекул, как указывает приведенное определение, но часто бывает удобно использовать этот термин также и для изменений, включающих одну молекулу (т. е. «микроскопическое химическое событие»).

German edition of the 'Red Book' published

A German edition of IUPAC's *Nomenclature of Inorganic Chemistry: Recommendations 1990* (the 'Red Book' Part 1) issued by the Commission of Nomenclature of Inorganic Chemistry and edited by G. J. Leigh has been published under the auspices of Gesellschaft Deutscher Chemiker (German Chemical Society) with the cooperation of Neuen Schweizerischen Chemischen Gesellschaft (New Swiss Chemical Society) and Gesellschaft Österreichischer Chemiker (Austrian Chemical Society). The German edition, which is entitled *Nomenklatur der Anorganischen Chemie: Deutsche Ausgabe der Empfehlungen 1990*, was prepared by W. Liebscher with the collaboration of J. Neels.

This volume, which is Part 1 of the *Nomenclature of Inorganic Chemistry*, contains recommendations for naming compounds ranging from simple hydrides to oxoacids and their derivatives, coordination compounds and simpler boron species. Subsequent volumes will be concerned with newer areas of chemistry requiring highly specialized and complex nomenclatures. These include the treatment of labelled compounds, inorganic and coordination polymers, polyoxoanions, and organometallic compounds.

Nomenklatur der Anorganischen Chemie: Deutsche Ausgabe der Empfehlungen 1990 *is published by VCH Verlagsgesellschaft mbH, Weinheim, Federal Republic of Germany, 1994. xxxii+ 340 pp. ISBN 3-527-25713-6. Price: DEM 148.00.*

Metrology

Basic and general terms in metrology

The second edition of *International Vocabulary of Basic and General Terms in Metrology – Vocabulaire international des termes fondamentaux et généraux de métrologie* has been prepared simultaneously in English and French by a joint working group consisting of experts appointed by:

BIPM International Bureau of Weights and Measures
IEC International Electrotechnical Commission
IFCC International Federation of Clinical Chemistry
ISO International Organization for Standardization
IUPAC International Union of Pure and Applied Chemistry
IUPAP International Union of Pure and Applied Physics
OIML International Organization of Legal Metrology.

ISO has published rules on the expression of measurement uncertainty for use within standardization, calibration, laboratory accreditation, and metrology services.

The 59-page vocabulary is published in the name of these organizations. The following is a list of contents:

Foreword (to the first edition)
Foreword (to the second edition)
Explanatory notes
1 Quantities and units
2 Measurements
3 Measurement results
4 Measuring instruments
5 Characteristics of measuring instruments
6 Measurement standard, etalons
Bibliography
English index
French index.

This is an example of one of the entries in the vocabulary:

> **2.6**
> (2.09)
>
> **measurand**
>
> particular quantity subject to measurement
>
> EXAMPLE vapour pressure of a given sample of water at 20°C
>
> NOTE The specification of a measurand may require statements about quantities such as time, temperature and pressure.

Expression of uncertainty in measurement

In 1978, recognizing the lack of international consensus on the expression of uncertainty in measurement, the world's highest authority in metrology, the Comité International des Poids et Mesures (CIPM), requested the Bureau International des Poids et Mesures (BIPM) to address the problem in conjunction with national standards laboratories and to make a recommendation.

BIPM prepared a detailed questionnaire covering the issues involved and distributed it to 32 national metrology laboratories known to have an interest in the subject (and, for information, to five international organizations). By early 1979 responses were received from 21 laboratories. Almost all believed that it was important to arrive at an internationally accepted procedure for expressing measurement uncertainty and for combining individual uncertainty components into a single total uncertainty. However, a consensus was not apparent on the method to be used. BIPM then convened a meeting for the purpose of arriving at a uniform and generally acceptable procedure for the specification of uncertainty; it was attended by experts from 11 national standards laboratories. This Working Group on the Statement of Uncertainties developed Recommendation INC-1 (1980), Expression of Experimental Uncertainties. CIPM approved the Recommendation in 1981 and reaffirmed it is 1986.

The task of developing a detailed guide based on the Working Group Recommendation (which is a brief outline rather than a detailed prescription) was referred by CIPM to the International Organization for Standardization (ISO), since ISO could better reflect the needs arising from the broad interests of industry and commerce.

Responsibility was assigned to ISO Technical Advisory Group on Metrology (TAG 4) because one of its tasks is to coordinate the development of guidelines on measurement topics that are of common interest to ISO and the organizations listed above that participate with ISO in the work of TAG 4.

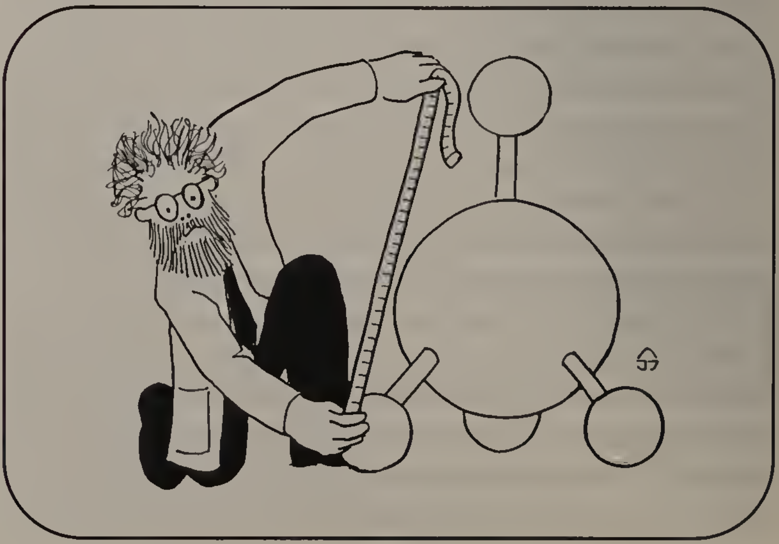
TAG 4 in turn established Working Group 3 (ISO/TAG 4/WG 3) composed of experts nominated by BIPM, IEC, ISO, and OIML and appointed by the Chairman of TAG 4. It was assigned the following terms of reference:

> To develop a guidance document based upon the recommendation of the BIPM Working on the Statement of Uncertainties which provides rules on the expression of measurement uncertainty for use within standardization, calibration, laboratory accreditation, and metrology services.
>
> The purpose of such guidance is
>
> - to promote full information on how uncertainty statements are arrived at;
> - to provide a basis for the international comparison of measurement results.

The guide is divided into eight chapters together with a forward (from which the above description is taken) and introduction. The chapter headings are: 1. Scope; 2. Definitions; 3. Basic concepts; 4. Evaluating standard uncertainty; 5. Determining combined standard uncertainty; 6. Determining expanded uncertainty; 7. Reporting uncertainty; 8. Summary of procedure for evaluating and expressing uncertainty.

There are also ten annexes: A. Recommendations of Working Group and CIPM; B. General metrological terms; C. Basic statistical terms and concepts; D. "True" value, error and uncertainty; E. Motivation and basis for Recommendation INC–1 (1980); F. Practical guidance on evaluating uncertainty components; G. Degrees of freedom and levels of confidence; H. Examples; J. Glossary of principal symbols; K. Bibliography.

International Vocabulary of Basic and General Terms in Metrology, *Second edition (English and French), 1993, pp. 59, ISBN 92-67-01075-1, and* Guide to the Expression of Uncertainty in Measurement, *First edition (English), 1993, pp. 101, ISBN 92-67-10188-9, are published by the International Organization for Standardization. Comments, suggestions and requests for clarification of the vocabulary and guide are welcome. They should be addressed to: The Secretary of ISO/TAG 4, ISO Central Secretariat, 1, rue de Varembé, CH–1211 Geneva 20, Switzerland.*



Asian symposium on global environmental change

A volume entitled *Proceedings of Asian Symposium on Global Environmental Change* has recently been published. The symposium was held in Tokyo, Japan, on 1–2 December 1992 under the auspices of the Japanese National Committee for IGBP (International Geosphere – Biosphere Programme) and hosted by the Science Council of Japan, Center for Global Environmental Research (CGER), National Institute for Environmental Studies (NIES) and the Environment Agency of Japan (EA).

For further information please contact: Shuzo Nishioka, Director, Center for Global Environmental Research, National Institute for Environmental Studies, Environment Agency, Government of Japan, 16–2, Onogawa, Tsukuba, Ibaraki, 305 Japan. Tel: +81 (298) 51 6111. Fax: +81 (298) 58 2645.

Veterinary drug residues in food

Evaluation of certain veterinary drug residues in food is the 40th report of the Joint Food and Agriculture Organisation of the UN/World Health Organization (FAO/WHO) Expert Committee on Food Additives and No. 832 in the WHO Technical Report Series.

The book presents the conclusions of an expert committee commissioned to evaluate the safety of residues of selected veterinary drugs used in food producing animals, to establish acceptable daily intakes for humans, and to recommend maximum residue limits. On the basis of a rigorous review of all available safety and residue data, the committee establishes international standards intended to promote food safety and facilitate the harmonization of international trade in animal products.

The report has two parts. The first explains several methodological issues that are specific to the safety assessment of veterinary drug residues in food. Noting problems posed by the inadequacy of data on veterinary drugs with a long history of use, the report establishes general principles of evaluation and requirements for toxicological data needed to ensure that the safety of these older products is established according to rigorous contemporary standards. General safety concerns, including the possible pharmacological effects of veterinary drugs in humans, are also discussed, together with specific issues relating to the estimates of food intake and the terminology used by the committee.

The second and most extensive part provides succinct summaries of the toxicological data examined and factors considered when evaluating each substance, identifying any potential hazards to consumer health, and allocating an acceptable daily intake and maximum residue limit. Veterinary drugs considered include five anthelminthics (closantel, flubendazole, ivermectin, tiabendazole, and triclabendazole), two antimicrobial agents (furazolidone and nitrofural), two production aids (bovine somatotropins and ractopamine), and a trypanodide (isometamidium). Acceptable daily intakes and maximum residue limits were established for seven of these drugs. For the remaining substances, the report identifies deficiencies in the available data and specifies the further information required for a re-evaluation.

A joint FAO/WHO has evaluated the safety of residues of selected veterinary drugs used in food producing animals.

Evaluation of certain veterinary drug residues in food: Fortieth Report of the Join FAO/WHO Expert Committee on Food Additives, Technical Report Series, No. 832, *(available in English; French and Spanish editions in preparation), published by World Health Organization, Geneva, Switzerland, 1993. xi + 62 pp. ISBN 92 4 120832 5. Price: CHF 10.-/USD 9.00; in developing countries: CHF 7.-. Order no. 1100832.*

Standard methods in cereal science

The September 1993 issue of *ICC Newsletter* (ISSN 0254-5837) describes the development of ICC standard methods. ICC is the International Association for Cereal Science and Technology. Its standards are usually developed by ICC working groups chaired by internationally recognized cereal scientists, tested for their international applicability in ring tests and the results obtained therefrom are secured by an internationally accepted statistical evaluation.

The first draft, including the statistical evaluation, is then sent to different ICC member organizations for testing and comments. After achieving a consensus of these organizations, the method is presented to the national delegates of ICC member countries as an ICC draft standard for adoption during the ICC general assembly. Thereafter, this draft standard is available to individual member countries for practical testing; should no objections be raised, after two years it is adopted by the general assembly as a definitive ICC standard. This means that the ICC member organizations, from their professional standpoint, accept the contents of the respective standard and that it can be if required incorporated into the legal systems of their countries.

Six years after definitive adoption, if new insights into the subjects matter have in the meantime been gained and suggest the necessity of changes, the standard method can be revised; if no changes are proposed, the standard method is submitted for a review in its original form.

ICC Standard Methods*: Basic + 1st, 2nd (Price USD 80.00 + postage) and 3rd Supplement (USD 120.00 + postage) is published in English by ICC General Secretariat, PO Box 77, Wienerstrasse 22A, A-2320 Schwechat, Austria. Tel: +43 (1) 707 7202. Fax: +43 (1) 707 7204. Telex: 133316.*

Solubility Data Series

Oxford University Press are the new publishers of IUPAC Solubility Data Series. They will be publishing Volume 54 onwards. For further details of prices and availability of back stock please contact:

Journals Subscription Department, Oxford University Press, Walton Street, Oxford OX2 6DP, UK. Tel. +44 (865) 56767. Fax +44 (865) 267773.

Laboratory biosafety manual

This book provides a detailed practical guide to essential safety precautions and techniques that should be followed in all laboratories handling infective micro-organisms. Recommended safety procedures and equipment are set out according to four levels of laboratory facilities dealing with increasingly hazardous pathogens, moving from basic laboratories handling routine samples of low-risk micro-organisms (biosafety level 1), to maximum containment laboratories working with highly dangerous pathogens (biosafety level 4).

Now in its second edition, the manual has been updated in line with new developments in equipment and improved knowledge of laboratory hazards and the best ways to prevent them. Details range from the simple advice that pipetting by mouth should be prohibited, through instructions for packing infectious substances for the post, to an explanation of the reasons why chemicals should not be stored in alphabetical order. Noting that safety equipment can generate a false sense of security, the book gives particular attention to the importance of alert and intelligent self-monitoring supported by appropriate supervision and surveillance.

The book has eighteen chapters presented in six main parts. Chapters in the first part set out fundamental rules governing safe laboratory design, equipment, and operation at each level of biosafety and in animal facilities. The second part, devoted to good microbiological practice, provides a detailed description of technical methods that can avoid or minimize the most commonly reported laboratory accidents. Additional chapters offer advice on the safe shipment of specimens and infectious materials, on contingency plans and emergency procedures, an on methods of disinfection and sterilisation.

Part 3, on laboratory equipment, contains two chapters. The first describes equipment and operations that may create hazards and suggests how such hazards may be eliminated or reduced. The second discusses the special features of safety equipment designed to eliminate or reduce hazards.

Chapters in the fourth part alert readers to the dangers of fire, electrical apparatus, and hazardous chemicals. The concluding parts provide advice on safety organization and training, and set out a 129-point checklist for assessing laboratory biosafety, moving from fire prevention, through the health and safety of staff, to the storage of chemicals and radioactive substances. Examples of various national and international safety codes are presented in an annex.

Laboratory Biosafety Manual, *2nd Edn (available in English; French and Spanish in preparation), published by World Health Organization, Geneva, Switzerland, 1993. xi + 133 pp. ISBN 92 4 154450 3. Price: CHF 26.-/USD 23.40; in developing countries: CHF 18.20. Order no. 1152213.*

ISO Standards

The following are some of the new international standards announced by the International Organization for Standardization (ISO) in recent issues of *ISO Bulletin*:

November 1993 issue of *ISO Bulletin*

TC 28	**Petroleum products and lubricants**
ISO3830: 1993	Petroleum products – Determination of lead content of gasoline – Iodine monochloride method
ISO 8819: 1993	Liquefied petroleum gases – Detection of hydrogen sulfide – Lead acetate method
ISO 1030-1	Petroleum products – Total sediment in residual fuel oils – Part 1; Determination by hot filtration
ISO 10307-2	Petroleum products - total sediment in residual fuel oils – Part 2; Determination using standard procedures for ageing
TC 34	**Agricultural food products**
ISO 7402: 1993	Microbiology – general guidance for the enumeration of Enterobacteriacae without resuscitation – MPN technique and colony-count technique
ISO 7932: 1993	Microbiology – general guidance for the enumeration of Bacillus cerus – Colony-count technique at 30 °C
TC 35	**Paints and varnishes**
ISO 3251: 1993	Paints and varnishes – Determination of non-volatile matter of paints, varnishes and binders for paints and varnishes
TC 38	**Textiles**
ISO 105-GO1: 1993	Textiles – Tests for colour fastness – Part GO1: Colour fastness to nitrogen oxides
ISO 105-GO2: 1993	Textiles – Tests for colour fastness – Part GO2: Colour fastness to burnt-gas fumes
ISO 105-GO3: 1993	Textiles – Tests for colour fastness – Part GO3: Colour fastness to ozone in the atmosphere
ISO 105-NO1: 1993	Textiles – Tests for colour fastness – Part NO1: Colour fastness to bleaching: Hypochlorite
ISO 105-NO2: 1993	Textiles – Tests for colour fastness – Part NO2: Colour fastness to bleaching: Peroxide
ISO 105-NO3: 1993	Textiles – Tests for colour fastness – Part NO3: Colour fastness to bleaching: Sodium chlorite (mild)
ISO 105-NO4: 1993	Textiles – Tests for colour fastness – Part NO4: Colour fastness to bleaching: Sodium chlorite (severe)
ISO 105-NO5: 1993	Textiles – Tests for colour fastness – Part NO5: Colour fastness to stoving
ISO 105-PO1: 1993	Textiles – Tests for colour fastness – Part PO1: Colour fastness to dry heat (excluding pressing)
ISO 105-PO2: 1993	Textiles – Tests for colour fastness – Part PO2: Colour fastness to pleating: Steam pleating
ISO 105-SO1: 1993	Textiles – Tests for colour fastness – Part SO1: Colour fastness to vulcanization: Hot air
ISO 105-SO2: 1993	Textiles – Tests for colour fastness – Part SO2: Colour fastness to vulcanization: Sulfur monochloride
ISO 105-SO3: 1993	Textiles – Tests for colour fastness – Part SO3: Colour fastness to vulcanization: Open steam
ISO 105-ZO1: 1993	Textiles – Tests for colour fastness – Part ZO1: Colour fastness to metals in the dye-bath: Chromium salts
ISO 105-ZO2: 1993	Textiles – Tests for colour fastness – Part ZO2: Colour fastness to metals in the dye-bath: iron and copper

ISO 2062: 1993	Textiles – Yarns from packages – Determination of single-end breaking force and elongation break
ISO 11092: 1993	Textiles – Physiological effects – Measurement of thermal and water-vapour resistance under steady-state conditions (sweating guarded-hotplate test)
TC 45	**Rubber and rubber products**
ISO 36:1993	Rubber, vulcanized or thermoplastic – Determination of adhesion to textile fabric
ISO 4661-1: 1993	Rubber, vulcanized or thermoplastic – Preparation of samples and test pieces – Part 1: Physical tests
ISO 5893: 1993	Rubber and plastics test equipment – Tensile, flexural and compression types (constant rate of traverse) – Description
TC 61	**Plastics**
ISO 3219: 1993	Plastics – Polymers/resins in the liquid state or as emulsions or dispersions – Determination of viscosity using a rotational viscometer with defined shear rate
ISO 4613: 1: 1993	Plastics – Ethylene/vinyl acetate (E/VAC) moulding and extruction materials – Part 1: Designation ad specification
TC 79	**Light Metals and their alloys**
ISO 6363-2: 1993	Wrought aluminium and aluminium allow cold-drawn rods/bars and tubes – Part 2: Mechanical properties
TC 119	**Powder metallurgy**
ISO 3953: 1993	Metallic powders – Determination of tap density
TC 146	**Air quality**
ISO 10396: 1993	Stationary source emissions – Sampling for the automated determination of gas concentrations
TC 150	**Implants for surgery**
ISO 5832-2: 1993	Implants for surgery – Metallic materials – Part 2: Unalloyed titanium
ISO 5832-5: 1993	Implants for surgery – Metallic materials – Part 5: Wrought cobalt–chromium–tungsten–nickel alloy
ISO 5832-10: 1993	Implants for surgery – Metallic materials – Part 10: Wrought titanium 5-aluminium 2, 5-iron alloy
ISO 5838-3: 1993	Implants for surgery – Skeletal ins and wires – Part 3: Kischner skeletal wires
ISO 9583: 1993	Implants for surgery – Non-destructive testing – Liquid penetrant inspection of metallic surgical implants
ISO 9584: 1993	Implants for surgery – Non-destructive testing – Radiographic examination of cast metallic surgical implants
TC 171	**Micrographics and optical memories for document and image recording, storage and use**
ISO 6196-1: 1993	Micrographics – Vocabulary – Part 01: General terms
ISO 6196-2: 1993	Micrographics – Vocabulary – Part 02: Image positions and methods of recording
TC 172	**Optics and optical instruments**
ISO 11252: 1993	Lasers and laser-related equipment – Laser device – Minimum requirements for documentation
ISO 11253: 1993	Lasers and laser-related equipment – Laser device – Mechanical interfaces
TC 193	**Natural gas**
ISO 10101-1: 1993	Natural gas – Determination of water by the Karl Fischer method – Part 1: Introduction
ISO 10101-2: 1993	Natural gas – Determination of water by the Karl Fischer method – Part 2: Titration procedure
ISO 10101-3: 1993	Natural gas – Determination of water by the Karl Fischer method – Part 3: Coulometric procedure

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TC 22	**Road vehicles**
ISO 3930: 1993	Road vehicles – Measurement equipment for exhaust gas emissions during inspection or maintenance – Technical specifications
TC 27	**Solid mineral fuels**
ISO 9411-2: 1993	Solid mineral fuels – Mechanical sampling from moving streams – Part 2: Coke
TC 28	**Petroleum products and lubricants**
ISO 4261: 1993	Petroleum products – Fuels (class F) – Specifications of gas turbine fuels for industrial and marine applications
TC 34	**Agricultural food products**
ISO 1134: 1993	Pears – Cold storage
ISO 8981: 1993	Wheat – Identification of varieties by electrophoresis
TC 35	**Paints and varnishes**
ISO 787-25: 1993	General methods of test for pigments and extenders – Part 25: Comparison of the colour, in full-shade systems, of white, black and coloured pigments – Colorimetric method
TC 38	**Textiles**
ISO 105-B05: 1993	Textiles – Tests for colour fastness – Part B05: Detection and assessment of photochromism
ISO 105-D01: 1993	Textiles – Tests for colour fastness – Part D01: Colour fastness to dry cleaning
ISO 105-D02: 1993	Textiles – Tests for colour fastness – Part D02: Colour fastness to rubbing: Organic solvents
ISO 105-X01: 1993	Textiles – Tests for colour fastness – Part X01: Colour fastness to carbonizing: Aluminium chloride
ISO 105-X02: 1993	Textiles – Tests for colour fastness – Part X02: Colour fastness to carbonizing: Sulfuric acid
ISO 105-X09: 1993	Textiles – Tests for colour fastness – Tart X09: Colour fastness to formaldehyde
ISO 105-X10: 1993	Textiles – Tests for colour fastness – Part X10: Assessment of migration of textile colours into polyvinyl chloride coatings
TC 42	**Photography**
ISO 5655: 1993	Photography – Film dimensions – Individual radiography
ISO 7272: 1993	Photography – Paper dimensions – Paper for documentary reproduction
ISO 11312: 1993	Photography – Film dimensions – Film for electronic scanner use
TC 61	**Plastics**
ISO/TR 10840: 1993	Plastics – Burning behaviour – Guidance for development and use of fire tests
TC 85	**Nuclear energy**
ISO 7195: 1993	Packaging of uranium hexafluoride (UF6) for transport
TC 94	**Personal safety – Protective clothing and equipment**
ISO/TR 11220: 1993	Footwear for professional use – Determination of slip resistance
TC 146	**Air quality**
ISO 9855: 1993	Ambient air – Determination of the particulate lead content of aerosols collected on filters – Atomic absorption spectrometric method
TC 147	**Water quality**
ISO 5667-7: 1993	Water quality – Sampling – Part 7: Guidance on sampling of water and steam in boiler plants
ISO 9391: 1993	water quality – sampling in deep waters for macro-invertebrates – Guidance on the use of colonization, qualitative and quantitative samplers
TC 180	**Solar energy**
ISO 9459-1: 1993	Solar heating – Domestic water heating systems – Part 1: Performance rating procedure using indoor test method

News& Views

Future opportunities in polymers

A round table discussion on future opportunities in polymers was organized within the IUPAC-sponsored International Conference on Advanced Polymer Materials held in Dresden, Germany, on 6–9 September 1993. The discussion was chaired by W. Faul, head of the body responsible for projects in materials and raw materials research of the Federal Ministry of Research and Technology. The panel consisted of representatives of university research (J. Economy, Illinois, USA; N. Ogata, Tokyo, Japan; G. Zachmann, Hamburg, FRG), the chemical industry (F. P. Boettcher, Du Pont, USA; E. Winkler, BASF; A. Schneller, Hoechst; R. Dujardin, Bayer) and the industries using polymers (W. Rogler, Siemens, J. Wartusch, Daimler-Denz).

The representatives of the chemical industry made clear that the trend is changing from development of novel polymer structures to further development and modification of commodity polymers. This trend is due to reasons of competitiveness in the chemical industry. Conventional polymers can be produced much cheaper and they can rather quickly be given desired properties by appropriate modifications. Novel polymer materials require considerably longer periods of development and their production is much too expensive in the foreseeable future. The market for newly developed specialty polymers is also small. However, it is finally the price that determines the competitiveness of a material.

The polymer users illustrated that improvement and modification of commodity polymers will not be able to meet all demands on future polymer materials. Consequently, they are interested in longer-term development of novel high-performance polymers. New appropriate possibilities to finance such developments, including risk and profit sharing, have to be found.

Altogether, the necessity of integrated materials research was underlined. On the one hand this means close cooperation between chemists, physicists, and technologists, and on the other hand a complex approach including development, manufacture, processing, end-use and recycling of polymer materials. In particular, further development of processing technologies should be closely linked with materials research, since it promises to open possibilities for lower production costs of high-performance polymers.

Researchers in universities and institutes are requested not to concentrate on research in novel high-performance polymers only and to pursue research with a view to the applications and potential markets of these polymers. Development of products, however, remains the task of industry.

This orientation is also given for researchers in Germany by the guidelines of the Federal Ministry of Research and Technology: development funds will be given mainly to application-oriented projects of materials research for the future key technologies (information technology, energy, transportation and medicine).

Prof. H. -J. Jacobasch

Round-table discussion on 'Future opportunities in polymers' at the International Conference on Advanced Polymer Materials held in Dresden, September 1993.

Prof. John Polanyi will be one of three Canadian Nobel Prize winners to speak at the Canadian symposium on 'Chemistry for Life'.

'Chemistry for life' event in Canada

The January 1994 issue of *Chem. Intl.* listed various national events celebrating the 75th anniversary of the formation of IUPAC. These events are based on the theme 'Chemistry for life'.

On 29 May 1994, a symposium based on this theme will be held in Winnipeg, Canada, in conjunction with the Canadian Society for Chemistry's Annual Meeting. The co-sponsors of the event are: the Canadian National Committee for IUPAC, the Canadian Society for Chemistry and the National Research Council of Canada. The three speakers at the symposium will be three Canadian Nobel Prize winners: Profs. R. A. Marcus, J. C. Polanyi and M. Smith.

Chemistry in Mongolia

There are a number of research and training institutes concerned with chemistry, science and technology in Mongolia. These include: the Chemistry Institute of the Mongolian Academy of Sciences, the Center for Chemistry and Technology of New Materials, Department of Inorganic Chemistry and Department of Biochemistry and Microbiology of the National University of Mongolia, Department of Chemistry and Physics of the National University of Medicine, Department of Agricultural Chemistry of the National University of Agriculture, the Central Geology Laboratory of the Ministry of Mining and Geology, the Research Center of Chemistry and Technology for Petroleum of the company 'Petroleum' and the National Research Center of Chemistry and Technology for Coal of the Ministry of Fuel and Energy.

As a result of their research into the chemistry and technology of rare earth elements, Mongolian inorganic chemists have synthesized a number of valuable materials from tin, copper, silver and gold. These chemists have also studied the chemical composition of more than 170 salts extracted from deposits in the country. Electrochemical methods have been used to convert some of these salts to chemical products of technical and economic value.

Prof. Badgaa is President of the Mongolian Chemical Society.

Organic chemists in Mongolia have also been active. In recent years they have synthesized more than 150 organic compounds, some of which have been screened for biological activity. In another field, coal chemists have established a technical classification of Mongolian coals and developed a technology for producing and using humic acid [*Ed:* Humic acid is a brown, polymeric constituent of soils, lignite and peat. It is not a well-defined compound, but a mixture of polymers containing aromatic and heterocyclic structures, carboxyl groups and nitrogen. It is used in printing inks, drilling fluids and for plant growth.]

Mongolian natural product chemists have investigated many of the plants in the country for medicinal and other purposes. Some of these plants have been used in Mongolian traditional medicine. They have identified about 3000 biologically active compounds including: alkaloids, flavonoids, coumarins, xanthones, terpenes, carbohydrates, essential oils and fatty acids. About 72 of these have been identified as new compounds. The results of these phytochemical investigations have been published in international journals such as *Phytochemistry*, *Natural Product Letters*, *Plant Medica*, *Phytochemical Analysis*, *Lipids*, *Journal of Plant Physiology* and so on.

Prof. D. Badgaa

Restructuring of ISO

The 16th General Assembly of the International Organization for Standardization (ISO), in extraordinary session on 24 November 1993 in Geneva, Switzerland, endorsed a package of ISO Council proposals for restructuring the Organization in order to meet the challenge it has set itself of delivering international technical standards for business and industry faster and better.

In brief, the principal measures are as follows:

1 A businesslike approach will be encouraged by an annual General Assembly, instead of every three years, and the introduction of a company-style annual report and agenda. The annual General Assembly will allow increased opportunities for all ISO members to participate directly in the primary policy setting, strategic planning and financial review activities of the Organization.

2 To streamline ISO's governance structure, a whole tier is being removed by dissolving the Executive Board – on the Board's own recommendation – and transferring its organizational and technical management responsibilities to respectively, a reconstituted ISO Council and Technical Management Board (the new title of the Technical Board).

3 Council will henceforth meet three times a year, instead of once, and the term of Council membership is being cut from three years to two in order to encourage a more frequent transfusion of fresh energy and new ideas.

4 The criteria for membership of the Technical Management Board are being altered to favour increased participation by developing countries and the small industrialized nations.

More details of these measures can be found in the January 1994 issue of *iso bulletin*.

Dr Rita Cornelis

Biological monitoring of chemical exposure at the work place

To improve the application of biological monitoring as an integral part of an overall safety strategy in Member States, the World Health Organization's Office of Occupational Health (OCH) and the Programme for the Promotion of Chemical Safety (PCS) set up a joint project on 'Biological Monitoring in Assessment of Risk from Exposure to Chemicals' in 1992.

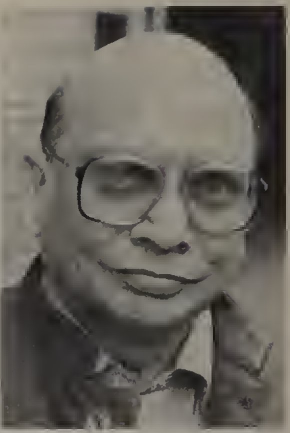
The planning meeting for the project was held in October 1992 in Kyoto, Japan, with the assistance of Prof. Ikeda from Kyoto University. During this meeting it was agreed that guidelines on biological monitoring of chemical exposure should be published by WHO.

At an informal meeting held in Geneva, Switzerland, on 14 December 1992, an outline of the 'Guidelines' was recommended. It was agreed that the document should be practical, and that relevant basic knowledge and clear concepts of biological monitoring should be given as general principles, with emphasis on quality assurance in a separate chapter. The remaining chapters should cover metals, solvents, pesticides and other chemicals. It was agreed that the selection of the individual chemicals to be included should follow the criteria proposed at the planning meeting in Kyoto..

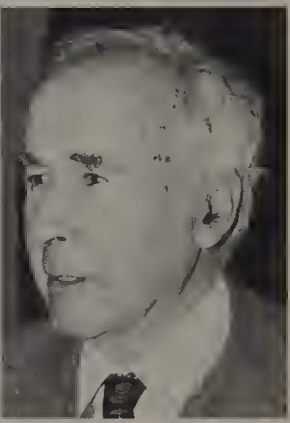
Six authors were invited to prepare drafts of chapters for the 'Guidelines'. Experts again convened in Geneva on 16–18 November 1993 for the purpose of discussing and revising the draft guidelines and to consider the further selection of chemical exposures which might also fulfil the criteria for biological monitoring. IUPAC was represented by Dr Rita Cornelis who is Chairperson of the Commission on Toxicology.

People

At its General Assembly in Brussels in June 1993, the Federation of European Chemical Societies elected **Dr Wolfgang Fritsche** (Germany) as honorary life president in recognition of his long and distinguished service to the federation since its inception. Fritsche was Secretary General of Gesellschaft Deutscher Chemiker (German Chemical Society), Secretary of Deutscher Zentralausschussfür Chemie (the IUPAC National Adhering Organization in Germany) and Chairman of the FECS Council. His contributions to *Chemistry International*, include a review of the German Chemical Society (*Chem. Intl.*, **13**, 87–92, 1991).



The American Chemical Society has selected **Prof. Krishna Sané** (University of Delhi, India) for the Brasted Memorial Award for 1994. The Award involves a visit to the USA from 31 July to 4 August and a lecture at the biennial Conference on Chemical Education at Lewisburg, PA. Sané is Chairman of the IUPAC Committee on Teaching of Chemistry (CTC). He has been involved with the IUPAC/UNESCO project for the development of low-cost equipment for chemical education (see *Chem. Intl.*, **11**, 127–8, 1989).



The International Council of Scientific Unions (ICSU) elected **Prof. Jonathan Cohen** (Queen's College, University of Oxford, UK) as Secretary General at its General Assembly in Santiago, Chile, October 1993. Cohen was Secretary of the Division of Logic, Methodology and Philosophy of Science (DLMPS) of the International Union of the History and Philosophy of Science (IUHPS) from 1975–83 and President of the IUPHS (DLMPS) in 1987–91.

Names and Addresses

Full details (names, addresses, telephone/telex/fax numbers, and e-mail) of officers of IUPAC bodies were published in *Chem. Intl.* **15**, 215–227 (1993). The IUPAC Secretariat has since been notified of the following changes:

Prof. H. A. FAVRE (Chairman, Commission on Nomenclature of Organic Chemistry). Tel: +1 (514) 343 6516.

Dr J. G. HILL (Secretary, Commission on Quantities and Units of the Clinical Chemistry Division). Department of Clinical Chemistry, Hospital for Sick Children, 555 University Avenue, Toronto, Ontario M5G 1X8, Canada. Tel: +1 (416) 813 6666. Fax: +1 (416) 813 6257.

Dr A. KALLNER (Secretary, Clinical Chemistry Division). Department of Clinical Chemistry, Karolinska Hospital, S–17176. Stockholm 60, Sweden.

Prof. H. P. LEHMANN (President, Clinical Chemistry Division). E-mail: hlehma@nomvs.lsumc.edu

Prof. A. M. SARGESON (Chairman, Commission on Nomenclature of Inorganic Chemistry). Research School of Chemistry, Australian National University, Canberra, ACT 0200, Australia.

Dr R. M. SMITH (Secretary, Commission on Separation Methods in Analytical Chemistry). E-mail: r.m.smith@mlut.ac.uk

Dr J. STEJSKAL (Secretary, Commission on Polymer Characterization and Properties). E-mail: stejskal@imc.cas.cz

Dr J. G. TOPLISS (President, Medicinal Chemistry Section). E-mail: john.g.topliss@um.cc.umich.edu

Prof. J. H. WENDORFF (Chairman, Commission on Functional Polymers). Fax: +49 (6421) 288916.

Prof. K. I. ZAMARAEV (President of IUPAC). E-mail: zam@iupac.nsk.su

Affiliate Affairs

Information for affiliates

IUPAC publications

Affiliates are entitled to a 25% reduction and in some cases a 40% reduction on the cost of IUPAC publications except the scientific journal *Pure and Applied Chemistry.* A leaflet detailing IUPAC books currently available from Blackwell Scientific Publications has recently been distributed by the publishers to all *CI* readers. Further copies may be obtained from the IUPAC Secretariat.

IUPAC-sponsored conferences

If you are interested in attending a conference please apply directly to the conference organizers for the conference circulars and registration forms. An updated list of names and addresses of the organizers of all future IUPAC sponsored conferences is given in the 'Conference Calendar' published in each issue of *CI.*

Affiliate reduction of conference registration fees

It is a condition of IUPAC sponsorship of a conference that IUPAC affiliates are entitled to a 10% reduction or 'own members' rate on the registration fee for scientific participants. This concession is usually, but not always, announced in the conference circulars and indicated on the registration form.

To receive this reduction an affiliate must declare on the conference registration form that (s)he is an affiliate. Alternatively the affiliate should apply in writing to the conference organizer for this reduction stating that (s)he is an affiliate. Conference organizers may check with the IUPAC Secretariat that applicants for this reduction are currently registered as affiliates.

If an application for this reduction is refused, an affiliate should immediately notify the Affiliate Affairs Secretary and, if possible, forward copies of documentary evidence of this refusal.

Ties and scarves

IUPAC ties and scarves may be purchased from the IUPAC Secretariat by applying to the Affiliate Affairs Secretary. The colours for both are *either* maroon *or* navy (dark) blue. The ties cost USD 14.00/GBP 7.00 each and the scarves USD 12.00/GBP 6.00 (including postage and packing).

Please use the form (or a photocopy of it) published on page 24 of the January 1994 issue of *CI.* Alternatively please write to the Affiliate Affairs Secretary with your order stating the colour you require. A cheque made payable to IUPAC for the appropriate amount should be enclosed with your order.

Address of IUPAC Secretariat

Please use the following address for all communications directed to the IUPAC Affiliate Affairs Secretary. If your are submitting a letter for publication in *Chemistry International* (*CI*), please indicate that the letter is 'Submitted for publication in *CI.*'

Affiliate Affairs Secretary, IUPAC Secretariat, Bank Court Chambers, 2–3 Pound Way, Templars Square
Cowley, Oxford OX4 3YF, UK.
Tel: +44 (865) 747744; Fax: +44 (865) 747510
E-mail: iupac@vax.oxford.ac.uk

How to contact commissions

IUPAC affiliates are entitled to communicate directly on scientific matters with the officers of IUPAC commissions. A full list of names and addresses of all commission officers for 1994–95 was published in the November 1994 issue of *CI.*

Balaban to receive Skolnik Award

IUPAC affiliate Alexandru T. Balaban, Professor of Organic Chemistry in the Faculty of Chemical Technology at the Polytechnic Institute, Bucharest, Romania, will receive the Herman Skolnik Award at the American Chemical Society National Meeting in Washington, D.C., in August 1994. The award, which is presented annually by the Chemical Information Division of the American Chemical Society, recognizes outstanding contributions to and achievements in the theory and practice of chemical information science.

Balaban is being recognized for his pioneering contributions to chemical graph theory and its applications to chemical nomenclature, classification of chemical structures and reactions, and coding of chemical information for computer storage and retrieval. He is viewed by many as the father of modern chemical graph theory.

Balaban received his PhD from the Polytechnic Institute, Bucharest in 1959 and progressed from teaching assistant to lecturer to professor at the Institute. He also has held research positions at the Institute of Atomic Physics, Bucharest, and at the International Atomic Energy Agency in Vienna. The author of more than 400 papers and 10 books, Balaban is a corresponding member of the Academy of the Socialist Republic of Romania, a fellow of the New York Academy of Science, and a fellow of the World Academy of Theoretical Organic Chemists. He has received the chemistry prize of the Romanian Academy and several Romanian orders and medals, including the Order of Scientific Merit.

Named for its first recipient, Herman Skolnik, the Skolnik award consists of a plaque and a USD 2000 honarium.

Commission & Committee News

Nomenclature of organic chemistry

When the Commission on Nomenclature of Organic Chemistry (III.1) met at the Lisbon General Assembly in August 1993, it acknowledged the publication of a major piece of nomenclature entitled 'Revised nomenclature for radicals, ions, radical ions and related species' (IUPAC Recommendations 1993), which appeared in *Pure Appl. Chem.* **65**, 1357-1455, (1993). In addition to this document, the revision of the 'Blue Book', *Nomenclature of Organic Chemistry*, Sections A, B, C, D, E, F and H, 1979 Edition, will appear early in 1994 under the name *A Guide to IUPAC Nomenclature of Organic Compounds, Recommendations 1993.* The guide will encompass Sections A, B, C, D, E and H.

Presently, three documents have reached the stage of public reviewing:

- A 'Glossary of class names, based on structure'. This document has been prepared jointly with the Commission on Physical Organic Chemistry (III.2).
- 'Basic terminology of stereochemistry'. This is also a joint publication with the Commission III.2.
- 'Phane nomenclature, Part I'.

The major project of Commission III.1 is the revision of all principles, rules, priorities, recommendations and conventions to arrive at the 'preferred name'. It is felt that a common language must be developed to cope with legal situations, with manifestations of patents, import-export regulations, health and safety information, protection of the environment, and simply to permit the expansion of nomenclature along precise, simple and rational lines. The revision will cover specific sections of the guide:

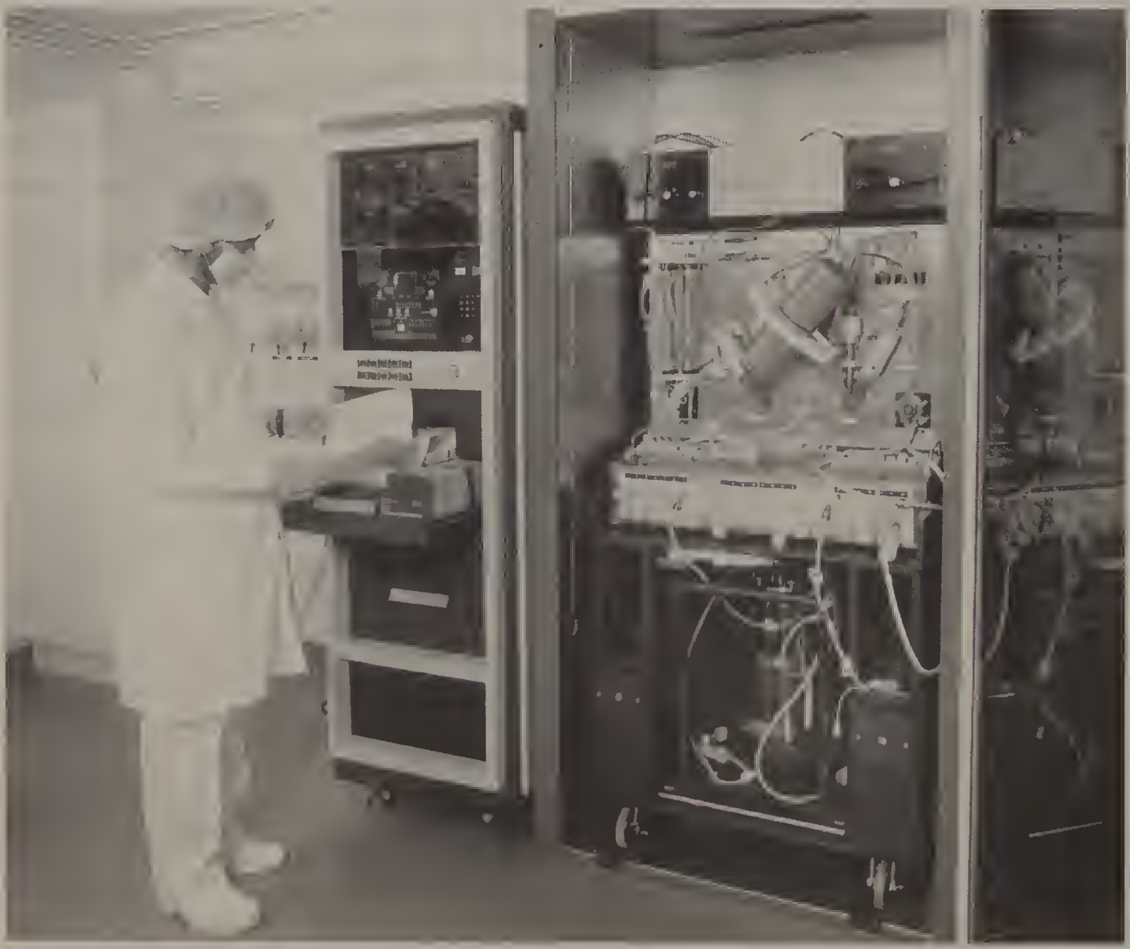
- general priorities according to the Periodic Table;
- suffixes and prefixes;
- priorities for choosing the principal chain;
- priorities for choosing the principal ring;
- priorities for naming compounds composed of rings and chains;
- recommendations for naming polycyclic compounds (von Baeyer type);
- priorities to change the degree of saturation– unsaturation of parent hydrides.

Two major documents are actually under final revision. They should be ready for public reviewing in the near future. They were initiated some time ago. The Commission wishes to make sure that they are compatible with the ongoing preoccupations to reach the 'preferred name' and also that they are computer-compatible. The first document deals with 'fusion names'; it will be the first all-encompassing presentation of fusion nomenclature. The second document covers the 'Nomenclature of natural products' as a revision of the recommendations which appeared in the Blue Book as Section F. A complete up-to-date list of stereoparent hydrides will be included in it.

A full day of the Lisbon meeting was devoted to a joint meeting with the Commission on Nomenclature of Inorganic Chemistry. The topics discussed included computerized nomenclature, the nomenclature of compounds containing elements of groups 14 and 15, as well as boron, and the nomenclature of organometallic compounds.

The next meeting of Commission III.1 will be held beside Lake Balaton, Hungary.

Prof. H. A. Favre



A common language of organic chemistry is required to cope with legal situations, patents, import-export regulations, health and safety information and protection of the environment.

Macromolecular nomenclature

1993 was a productive year for the Commission on Macromolecular Nomenclature (IV.1). Publication of 'Nomenclature of regular double-strand (ladder and spiro) organic polymers' took place in the July issue of *Pure Appl. Chem.* and three other documents, 'Basic classification and definitions of polymerization reactions', 'Graphic representations (chemical formulae) of macromolecules' and 'Structure-based nomenclature for irregular polymers', completed their review period and should be published in 1994.

In response to public comments to 'Basic classification and definitions of polymerization reactions', which attempts to clarify the names of well-known polymerization reactions, the Commission decided, despite a few objections to coining a new word, to adopt the term *condensative chain polymerization* for those chain reactions that simultaneously form small molecules during polymerization. The Commission decided against the suggested use of *step polymerization* to embrace both *polycondensation* and *polyaddition* because all polymerizations take place in steps.

Public review suggested only minor modifications to 'Graphic representations (chemical formulae) of macromolecules'. This document provides rules to aid in developing an unambiguous picture of the structure of a macromolecule.

The document on 'Structure-based nomenclature for irregular polymers' provides rules for structure-based names to be assigned to irregular polymers. The nomenclature applies to polymers subjected to chemical reactions modifying the macromolecule. Such reactions often result in a variety of different structural elements in the molecule that make naming difficult by existing nomenclature. The rules proposed here break the macromolecule down to its largest structural features to serve as the starting point for developing a name based on those structural units. Although not intended to supplant source-based nomenclature for copolymers, structure-based names can be developed for them as well by following the rules developed in this document. Comments received during the public review period proposed only minor changes to the document.

On-going projects

The Commission's projects on 'Non-linear polymers, networks, and blends' and 'Definitions of terms relating to low molar mass and polymeric liquid crystals' were sent to external experts for comment during 1993. Only minor changes were suggested for either document. 'Non-linear polymers, networks, and blends' attempts to address the need for terminology and nomenclature in these materials and 'Liquid crystals' includes terminology for both low molar mass liquid crystals and polymer liquid crystals. After revision according to the decisions of the Commission at the 1993 meeting, both documents should be ready for public review in 1994.

'Degradation and aging of polymers' attempts to define the fundamental terminology of this field. Much discussion at the 1993 General Assembly meeting in Lisbon centred on the fundamental definitions of *aging* and *degradation*. Some of the issues raised were whether aging is irreversible, whether aging is always detrimental to the polymer, whether the time-span for aging is restricted to longer time intervals, and whether some detectable change must be present in the polymer. The major point raised during the discussion of *degradation* concerned whether bond-breaking always occurs during a degradation process.

The project to develop a new 'Glossary of basic terms' is intended to add a significant number of new terms and definitions to the Commission's 1974 document. It will be ready for review by external experts once the revisions agreed to at the Commission's meeting are complete.

The Commission on Macromolecular Nomenclature at Lisbon.

Another project that is in an early stage of preparation is the 'Revision of regular, single-strand nomenclature'. The principal aim of this work is to expand and develop the Commission's 1975 document and to include regular, single-strand macromolecules that did not have specific rules recommended then. A new version was presented to the Commission in 1993 and numerous small changes were agreed upon. It will be revised and reviewed by the Commission again in 1994.

New projects

Four new projects, to replace those completed in 1993, were submitted for IUPAC approval from the five feasibility studies conducted over the last year. The first 'Terminology related to multiphase polymeric composites and blends' has as its goal to clarify the terminology used in multiphase polymer composites, blends, and their mixing behaviour. The second, 'Source-based generic nomenclature for polymers', aims to provide simplified rules for identifying polymers resulting from a sequence of chemical reactions clearly according to their type and monomer sources. Such polymers are difficult to name concisely by existing macromolecular nomenclature. The third 'Definition of terms relating to the non-ultimate mechanical properties of polymers' aims to provide the basis and definitions of widely used mechanical properties in unambiguous terms. The last, 'Guide to polymer terminology and nomenclature' is intended to bring polymer terminology and nomenclature to a wider audience.

Feasibility studies under consideration are 'Thermal, electrical, optical, magnetic, and sonic properties, kinetics and thermodynamics of polymerization', and 'Seniority rules for orienting block copolymers'.

When it met in Lisbon, the Commission noted with satisfaction that the 'Purple book' (*Compendium of Macromolecular Nomenclature*) had been translated into Spanish.

The next meeting of Commission IV.1 will take place from 6–9 July 1994 at Chemical Abstracts Service, Columbus, Ohio, USA.

William J. Work

Chemical thermodynamics
Clermont-Ferrand, France
17–22 July 1994

IUPAC
SPONSORED

The 13th International Conference on Chemical Thermodynamics and the 25th AFCAT Conference joint meeting will be organized by the Laboratory of Thermodynamics and Chemical Engineering, Blaise Pascal University, Clermont-Ferrand, and will be held in Clermont-Ferrand, France, on 17–22 July 1994.

The conference aims to gather scientists working in different fields (broadly physical chemistry, chemical physics, chemical engineering, materials science and biophysical chemistry) and using chemical thermodynamics to deal with subjects of practical importance and for current interest. The conference will consist of 10 symposia, presenting a total of 11 plenary lectures (including the Rossini Lecture) of 45 minutes each, about 20 invited lectures of 30 minutes each, as well as short communications of 15 minutes duration (about 200 short communications are expected), and also poster sessions. The 10 symposia will cover the following topics:

1. Experimental thermodynamics (calorimetry, instruments, new techniques);
2. Non-electrolyte mixtures and molecular fluids (including the IUPAC workshop on ternary mixtures of ethers, alkanols and alkanes);
3. Aqueous solutions at superambient conditions, including geochemical and petroleum applications;
4. Interfaces, polydispersed systems and colloids;
5. Biothermodynamics, health and environment;
6. Advanced materials and new technologies (including electrolyte solutions, solid state and metallurgy);
7. Polymeric materials;
8. Nuclear materials (including handling and treatment of nuclear materials and wastes);
9. Fluid phase, energy and industrial (including thermal fluids and refrigerants;
10. Databases/databanks (including chemical databases and software demonstrations).

All lectures will be presented in English.

The registration fees before/after 1 May 1994 will be USD 245/285 for regular participants and USD 125/135 for students. IUPAC affiliate members are entitled to a 10% reduction. Provided sufficient funds are available, a limited number of scientists from Eastern Europe and developing countries will be supported by the organizers of this conference by applying student-level registration fees. Non-scientist accompanying persons will be able to register without any fee. However, for all persons (active scientific participants and accompanying persons) the charge for the banquet is USD 35 per person and for four lunches the charge is USD 60 person. An accompanying person programme as well as excursions during the conference will be arranged.

The venue of the conference is Clermont-Ferrand, the capital of the Auvergne Region in the heart of France and Western Europe (the city has *c.* 300 000 inhabitants). Clermont-Ferrand, located 400 km south of Paris and 150 km west of Lyon, is a city of history and art, well known for its black-stone monuments dating back to the 11th century. This includes, for instance, the medieval city of Montferrand, the church Notre Dame du Port (a romantic masterpiece), the flamboyant gothic cathedral and several renaissance buildings. The city is the birthplace of Blaise Pascal and the home of the Michelin tyre company. Recently, it has attracted an active pharmaceutical industry.

The summer climate at Clermont-Ferrand is characterized by rather warm days with temperatures up to 35°C and nights with cool temperatures dropping to about 20°C. Occasional afternoon thunderstorms are not uncommon.

All conference sessions will be held in the Maison des Congrès near the center of the city. All the hotels and the residences are situated within walking distance. The Maison des Congrès offers modern facilities for meetings, that is lecture rooms for 50–200 to 1000 people. Several halls and areas are available for poster sessions, scientific displays and exhibits.

Clermont-Ferrand: statue of Vercingetorix (Francs Chief who fought Caesar) by the sculptor Bartholdi. The mountain in the background is Le Puy-de-Dôme where Blaise Pascal performed his measurements on atmospheric pressure.

Local air pollution in rapidly developing countries
Cheng De, People's Republic of China
20–21 July 1994

IUPAC
SPONSORED

A Workshop on Local Air Pollution in Rapidly Developing Countries will be held in Cheng De, People's Republic of China, 20 and 21 July 1994. The Workshop is sponsored by IUPAC; NEPA (National Environmental Protection Agency, China), Chen De EPB (Environmental Protection Bureau), The Centre of Environmental Sciences (Peking University) and ECN (Netherlands Energy Research Foundation).

The Cheng De Workshop will examine air pollution problems in different countries.

The Workshop, which will be held under the supervision of the IUPAC Commission on Atmospheric Chemistry (VI.4), aims to transfer knowledge of the assessment of local air pollution problems acquired in Europe and the USA to rapidly developing countries, especially those in East Asia.

In order to promote interactive discussions, the number of participants will be limited to about 60.

The following topics will be covered in invited oral lectures, posters and discussions:

- Emission inventories for assessment of local air pollution problems.
- Methodology and measurement strategy.
- Local oxidant problems.
- Regional acid deposition due to local sources.
- Local air pollution problems in different countries.

The Scientific Committee is formed by Commission VI.4 (Chairperson, J. Slanina, and Secretary P. Warneck). The Local Organizing Committee is chaired by Prof. X. Tang (Peking University). The proceedings, comprising oral presentations and posters, will be published in IUPAC's scientific journal, *Pure Appl. Chem.*

The Workshop will take place in the Yunshan (Cloud Mountain) Hotel in Cheng De, Hebei Province, 250 km south east of Beijing. Cheng De is famous for the 'Imperial Summer Resort', Bishushanzhuang (The Mountain Manor for Escaping the Summer Heat). An excursion is planned on Friday, 22 July. The cost will be about USD 15.

The participation fee is USD 150. This fee covers transportation from and to Beijing. The fee for accompanying persons is USD 60.00 The hotel charge is USD 50 per night.

Macromolecules
Akron, USA
11–15 July 1994

IUPAC
SPONSORED

The University of Akron, located in the heart of the USA's 'Polymer Valley', will be the site of the 35th International Symposium on Macromolecules (MACROAKRON'94), scheduled for 11–15 July 1994.

An estimated 2000 polymer scientists are expected to attend this IUPAC sponsored conference.

Known throughout the world for its polymer programme, The University of Akron is situated in northeast Ohio, about 35 miles south of Cleveland. Once known as the 'Rubber Capital of the World', in recent years the city has gained a reputation as a growing centre for polymer research, education and industry.

The Symposium will feature four plenary speakers: Andrew Keller (University of Bristol, UK), Toyoki Kunitake (Kyushu University, Japan), Helmut Ringsdorf (University of Mainz, Germany) and Walter Stockmayer (Dartmouth College, USA).

Additionally, more than 100 invited lecturers will present papers at technical sessions, most of which will be held at the University's E. J. Thomas Performing Arts Hall. Major topics for discussion will include:

- New polymerization reactions and reaction mechanisms.
- Complex macromolecular architectures and supramolecular polymers.
- Polymers and biology.
- Frontier polymeric materials.
- Field responsive polymers.
- Structure and morphology.
- Thermodynamic and dynamic properties in solution and bulk polymers at interfaces.
- History of polymers.

Also scheduled is a presentation on 'Industrial views on polymers in the 21st Century'.

Dr Joseph P. Kennedy, who is Distinguished Professor at The University of Akron's Institute of Polymer Science, is organizing chairperson for the Symposium. Case Western Reserve University's Dr Jerry Lando and Dr Virgil Percec are co-chairing the programme committee.

Conference participants and guests will have an opportunity to tour the 170-acre University of Akron campus, where approximately 29 000 students are enrolled during the academic year. Among the facilities to be toured is the University's new

USD 17 million Polymer Science Building. One conference event, an 'All American Evening', will be held at Akron's new Convention Center, which will open this spring.

The city of Akron is located in a metropolitan area of 1.5 million residents. In July, the temperature varies from a low of 60°F, which is rare, to highs in the 1980s and '90s

To accommodate symposium guests, rooms are being reserved at 15 Akron-area hotels. Housing also is available at reduced rates in campus residence halls. A number of fine restaurants are located within walking distance of the University, and meals also may be purchased at the Gardner Student Center.

Special activities for persons accompanying conference participants will include tours of Akron and Cleveland, a visit to

The Polymer Building, The University of Akron.

Sea World, the Goodyear World of Rubber Exhibition, the Pro-Football Hall of Fame in nearby Canton, Kent State University's Fashion Museum, and Stan Hywet Hall and Gardens, the former home of the co-founder of Goodyear and Seiberling Rubber companies.

Several pre- and post-symposium tours throughout the United States and Canada are also being offered through an Akron travel agency.

After 15 April, the registration fee for the conference is USD 550. The fee for one-day participants is USD 200. Affiliate members of IUPAC are entitled to a 10% reduction in fees.

Discounted fees of varying amounts are also available to college faculty, student participants, accompanying guests and scientists from the former USSR, Yugoslavia and Czechoslovakia, as well as from Bulgaria, Hungary, Poland and Romania.

Reservations will be accepted until 1 June.

Raman Spectroscopy
Hong Kong
22–26 August 1994

IUPAC
SPONSORED

The 14th International Conference on Raman Spectroscopy will be held in Hong Kong at the beautiful seaside campus of the Hong Kong University of Science and Technology, from 22–26 August 1994. Hong Kong, the financial heart of Asia, is centrally located and served by all major airlines. The HKUST, opened in 1991, with the mandate to become one of the eminent technological research universities in the world.

The ICOR'94 aims to bring together all interested scientists to disseminate original and significant research in progress in all aspects of Raman spectroscopy. The conference will consist of one Keynote speaker, 9 plenary lecturers, 50 invited speakers and poster sessions. The scientific sessions will cover the following topics:

- Theoretical advance in Raman scattering
- Hemoproteins and related compounds
- Proteins/nucleic acids/viruses
- Biomolecules: structure and dynamics
- Biomedical applications
- Vibrational analysis: methodologies and bio-applications
- Resonance Raman spectroscopy
- Carbon-60 and related molecules
- Semiconductors
- Superconductors
- Non-linear Raman: CARS/RIKES
- Ultrafast phenomena
- Time-resolved Raman and transient species
- Inorganic/organometallic systems
- SERS & SEHRS
- Advanced materials
- Polymers and supramolecules
- The solid state
- Industrial process and environmental applications
- Raman studies at extreme environments
- Raman IR imaging
- Near IR-excited Raman FT-Raman
- Molecular conformation
- Band shapes and dynamics
- Band intensities
- Vibrational analysis and molecular structure
- Phase transitions
- Low dimensional and amorphous solids
- Raman Microscopy
- New techniques

The registration fees before 1 June 1994 will be USD 400 for active participants; USD 200 for students; USD 200 for accompanying persons. The conference proceedings, banquet and social events are included in the registration fees.

Low-cost but comfortable accommodation will be available in the University student halls and at downtown 4-star hotels in the Tsim-Sha-Tsui area. The programme for accompanying persons will tentatively include a trip to Macao (a Portuguese colony), a shopper's bargain tour and a visit to the Middle Kingdom where one can walk through the history of China

The average summer temperature is 26–30 °C.

HKUST.

Chemical education San Juan, Puerto Rico 8–12 August 1994

IUPAC SPONSORED

The 13th International Conference on Chemical Education (ICCE) will be held at Inter American University of Puerto Rico, Metropolitan Campus, on 8–12 August 1994. It will be the first time that an ICCE meeting will be held in the Caribbean. The objective of this conference is to bring together chemists, and pre-college and college chemistry teachers to share their ideas and learn from each other about the frontiers of chemistry and about innovations in the teaching and learning process. Chemists and chemistry educators from over sixty countries are expected to attend the 13th ICCE and share their ideas and approaches.

A sound basic scientific and technological education, combined with co-operation at the international level, if fundamental to world economic development with due regard for the global environment and the quality of human life. The 13th ICCE will help us achieve this co-operation.

The 13th ICCE will have five themes around which the plenary lectures, symposia, workshops, and the poster sessions will resolve:

- Curriculum development, creative teaching and assessment;
- Low cost materials and equipment;
- The future of the environment;
- Teacher training, enhancement, and empowerment;
- Chemistry in the 21st Century.

Eight plenary lectures from world-renowned speakers, such as Marye Anne Fox, Ahmed Zewail, USA; David Samuels, Israel; Robyn Williams, Australia; F. S. Rowland, USA; Mansoor Niaz, Venezuela; Abimael Rodríguez, Puerto Rico; Cyril Ponnamperuma, USA, have been invited to discuss, debate and contemplate on recent topics such as: Chemistry and the key to the future; Lasers in chemistry and chemical education; Brain chemistry; Cognitive development and its implication for chemistry teaching; Isolation and characterization of biochemically important compounds from the Caribbean Sea. In addition, more than twenty five symposia and the same number of workshops will give a clear and accurate description of the state of chemistry and chemistry teaching world-wide. The speakers will summarise the current work, concerns, and thinking of the world community on the nature and professional character of chemistry, chemical educators, and other chemists.

It is expected that the speakers will develop the theme 'Chemistry: the key to the future' in such a manner as to show how chemistry, the central science, will continue to guide the future of all sciences into the 21st century. In addition to the plenary lectures, symposia and workshops, the conference will feature special lectures, poster sessions and exhibitions. In addition, sociocultural activities will be an important part of the conference. The official language of the conference will be English.

It is estimated that about six to seven hundred participants from over sixty countries (about 20% industrialised, 40% developing and 40% underdeveloped) will participate in the 13th ICCE. Since the ICCE is being held in the Caribbean Region participants from the Latin American World will have a unique opportunity to attend this event.

Metropolitan Campus, Inter-American university of Puerto Rico.

Puerto Rico has warm weather, with an average temperature ranging between 22 and 30 °C. The month of August has short-lived and refreshing tropical showers, mainly in the early morning or late afternoon. The registration fees for the participants is USD 100 for the accompanying persons and students. After 31 May 1994 an additional fee of USD 50 will be charged. IUPAC affiliate members are entitled to a 10% reduction.

In addition to IUPAC and UNESCO, we expect that the 13th ICCE will be co-sponsored by the American Chemical Society. It will be held at Inter American University of Puerto Rico (IAU), Metropolitan Campus in collaboration with The College of Chemists of Puerto Rico, American Chemical Society (local and national levels), Bacardi Corporation, the tourism Company of Puerto Rico, Ana G. Méndez Foundation, Pontificial Catholic University of Puerto Rico, Department of Education of Puerto Rico, Resource Centre for Science and Engineering, University of the Sacred Heart, University of Puerto Rico and Council of Higher Education.

Macrocyclic ligands for the design of new materials Buenos Aires, Argentina 29 August – 1 September 1994

IUPAC SPONSORED

The second symposium on this topic will be held in Buenos Aires from 29 August – 1 September 1994 following the IUPAC 6th Solubility Symposium (from 22–26 August). This meeting is organised by the European Latin American Research Group (set up to deal with the topic of the symposium), the National University of the South, Argentina, and the University of Surrey, UK under the chairmanship of Dr Angela Danil de Namor.

There will be plenary and invited lectures by internationally known experts, poster sessions, and round tables to discuss strategies for research collaboration between Europe and South America.

The symposium will draw delegates from South and North America, Europe and many other regions. The first symposium (1992) was attended by 120 delegates from about 30 countries.

The major purpose is to provide a forum for discussions on macrocyclic ligands another role in the design of new materials for environmental, recognition and extraction processes. The major themes are:

- Synthetic aspects
- Structural analysis
- Thermodynamics and kinetics
- Applications particularly in metal extraction, surface chemistry, environmental chemistry and separations of chiral molecules and biologically active natural products.

The registration fees before/after 1 March 1994 will be USD 300/350 for participants; USD 60/75 for students and USD 80/100 for accompanying persons. IUPAC affiliate members are entitled to a 10% reduction. An accompanying person programme including excursions during and before the symposium will be arranged. The symposium will be held at the Bauen Hotel, Buenos Aires but accommodation for delegates and others at smaller, neighbouring hotels will be possible. The Bauen Hotel has excellent conference facilities as well as the other facilities expected from a first class hotel. It is located in the centre of Buenos Aires.

Buenos Aires, one of the most sophisticated Latin American cities, has a rich tradition and an exciting present. The city is cool in late August as the season changes to spring so that some warm clothing is recommended.

Liquid crystal polymers
Beijing, China
6–9 September 1994

IUPAC
SPONSORED

The International Conference on Liquid Crystal Polymers ('94 ICLCP) will be held at the 21st Century Hotel, Beijing, China.

The conference will be devoted to theoretical and experimental aspects of the science of liquid crystal polymers including: synthesis, structure and conformation, phase changes, texture, defects and instability, dynamic aspects, rheology, electro-optic effects, thermotropic and lyotropic materials, polymer composites, networks, and applications.

The conference will consist of contributed papers, poster sessions and the following 20 plenary lectures:

- D. G. Baird: On blends of LCP with thermoplastics.
- E. Chiellini: Chiral LCPs.
- J. W. Doane: Polymer stabilized and modified liquid crystals for displays and light shutters.
- J. Economy (title to be decided).
- H. Finkelmann: Smectic liquid single crystal elastomers (LSCE).
- F. Hardouin: Polymorphism and structure in different kinds of liquid crystal side chain polymers and copolymers.
- J-I Jin: Aromatic polyesters containing phenyl-substituted biphenyl and naphthalene moieties.
- R. W. Lenz (title to be decided).
- G. R. Luckhurst: Liquid crystal oligomers: experiment and theory.
- A Misra: Processing and properties of blends of LCPs with engineering thermoplastics.
- C. Noel: Side chain LCPs: electric field effects, non-linear optical properties.
- N. Ogata: Micro-composite systems by in-situ formation of LCPs in commodity polymers.
- V. Percec: Supramolecular LCPs.
- N. Plate: Rheological behaviour and mechanical properties of some novel thermotropic LCPs.
- R. Qian: Recent advances in the observation of disclinations of main-chain nematic polymers.
- E. T. Samulski: LCPs derived from thiophene.
- H. W. Spiess: Dynamics in LCPs of different molecular architecture.
- I. M. Ward (title to be decided).
- J. Wendoff: Liquid crystalline polymers: from self-organization to function and applications.
- Y. Yang: (title to be decided).

All 20 lectures will be presented in English. Simultaneous translation will not be available.

The pre-registration fees (before 31 May 1994) are USD 330 for delegates, USD 300 for IUPAC affiliates, USD 180 for students and USD 150 for accompanying persons. The fees include admission to the scientific sessions, conference materials, a copy of the *Conference Abstracts* for scientific participants, attendance at the welcome reception, coffee breaks, banquet and an excursion to the city centre.

Beijing is the capital of the Peoples Republic of China and has been the cultural centre of the country since the 10th century. It is the home of 60 universities and colleges, and a number of research institutions. There are many places of historical interest including the Great Wall, the Forbidden City (Palace Museum), Ming Tombs, the Summer Palace, the Temple of Heaven, and Tian An Men Square. In recent years tourism and transport in Beijing have greatly improved and Beijing is now a modern, metropolitan city.

Blocks of rooms in the 21st Century Hotel, which is situated in south Beijing, ten minutes by car from the city centre, have been reserved. The hotel, a joint-venture invested with governmental funds from China and Japan, possesses a group of up-to-date architectural structures and offers good services for scientific conferences.

ICLCP Conference Chairman Prof. Q. F. Zhou (left) and Secretary Prof. X. J. Wang.

Thermal analysis and calorimetry
Grado, Italy
11–16 September 1994

IUPAC
SPONSORED

The 6th European Symposium on Thermal Analysis and Calorimetry, organized by the Italian Association of Calorimetry and Thermal Analysis (AICAT) will be held in Grado, Italy, on 11–16 September 1994. The venue is a small seaside resort town on the North-Adriatic coast, between Venice and Trieste.

Grado.

The symposium is open to all topics related to the application, understanding and advancement of thermal analysis and calorimetry. Contributions (plenary, invited, oral and poster communications) will deal with theory, instrumentation, and applications in the fields of physics, chemistry, material sciences, earth sciences, bio-sciences, pharmacy and environmental sciences.

Workshops will deal with: controlled rate thermal analysis; glass transitions; past, present and future in calibration; calorimetry in biological systems; new directions for thermal analysis kinetics; and organic and pharmaceutical chemicals.

The official language of the conference will be English.

The registration fees (inclusive package of registration and accommodation in four star hotels) will be

ITL 900 000 for participants and ITL 750 000 for accompanying persons. A limited number of low-cost places in other hotels can also be reserved. IUPAC affiliate members are entitled to a reduction of 10% on the registration fee only. A programme of excursions has been arranged.

The symposium will be held in a location with excellent facilities at relatively low prices. In September the weather in Grado is usually warm and dry. The average air temperature ranges from 15 to 25°C and sea temperature is 21°C.

Geotoxicology
Oxford, UK
18–22 September 1994

IUPAC
SPONSORED

The International Conference on Geotoxicology: Mutagens and Clastogens in the Environment, is being organized by the School of Geography at the University of Oxford, UK, with support from the European Science Foundation, the United Kingdom Environmental Mutagenicity Society, and the Linnean Society of London.

The meeting is called to assemble bioinorganic and physical chemists, geneticists, toxicologists, biologists, ecotoxicologists, geographers and environmental scientists to share the insights provided by their disciplines on the characteristics and behaviours of four types of genotoxic substance: metals, the actinides, hydrocarbons and lipophilic compounds.

Whilst the meeting is open to free papers and posters, it is intended to function primarily as a workshop to allow time for questions and discussion. The rationale for the meeting is that whilst cross-disciplinary research is universally allowed to be desirable, and society is increasingly demanding that we undertake it, building effective collaborations requires an understanding of the work and the results of other scientists which we rarely have the time or expertise to acquire. According to Conference organizer Dr Katherine Kaye (University of Oxford), reading into the literature outside one's subject is not an efficient first approach given the increase in the number of journals published and the intense specialization demanded by the intellectual and career structures in science today.

This workshop meeting will provide congenial surroundings and a positive atmosphere in which to enquire, to challenge and to complement the lines of inquiry pursued by colleagues with a view towards comparing questions, improving techniques, avoiding blind alleys, and developing further collaborations.

Topics to be addressed at the meeting include:

Metals, metal salts and organometals

- Metal-catalysed free-radical production
- Metal-hydrocarbon complexes (e.g. MeHg, TBT, Pb-octanols, war combustion products)
- Metals and metal salts: problems in analysis and identification as mutagens
- Selenium–metal complexes
- Molecular targets of genotoxic and teratogenic metals
- The structural chemistry of natural bioligand–genotoxic-metal bonds
- Chelates: genotoxins and organometals

Hydrocarbons

- Hydrocarbon-membrane interactions and hydrocarbons as lipophiles
- The mutagenic properties of polycyclic aromatic hydrocarbons

Integrative concepts

- Modelling at molecular and environmental transport levels
- Co-mutagenicity and anti-mutagens
- Correlations between genotoxicity and artifacts of other toxicological, biological changes
- Biomarkers of genotoxicity
- Genetically vulnerable populations: human and non-human genotoxicity

Actinides

- Mechanisms of biotransformation of actinides
- The ligand chemistry of actinide accumulation in higher and lower plants

Dr Katherine Kaye.

School of Geography, Oxford University.

Lipophiles

- Mutagenicity of chlorinated humic substances
- The distribution, chemistry, ecology and genotoxicity of anthropogenic hydrocarbon-metal complexes in Eastern periurban and agricultural environments
- Windows of opportunity: structural constraints on lipophile-metal complex interactions with DNA
- Lipophile–metal complexes: bioaccumulation and environmental no-effect levels.

Invited lecturers include: Prof. F. William Sunderman, Jr. (Connecticut), Prof. Henryk Kozlowski (Wroclaw). Dr Murray Feshbach (Georgetown), Dr Daniela Rhodes (LMB Cambridge), Dr Grazyna Motykiewicz (Columbia), Dr Stanley Openshaw (Newcastle), and Dr Ewa Gryzbowska (Karolinska Institute).

Oxford is a commercial and university town of some 120 000 people. It lies at the confluence of the river Thames (or Isis) and the Cherwell. It is bounded on the east by Shotover Hill, and on the west by Boar's Hill and the Wytham Woods, home of Oxford University's forest and agricultural research station. To the north lies the village of Woodstock, adjoining the Churchill family's estate at Blenheim; southward lies the Vale of the White Horse, where the figure of a horse, over 30 m in size, dating from Neolithic times, has been cut into the chalk escarpment of the Ridgeway. Oxford is home to over 400 grade-I 'listed buildings', including those of the colleges and the many churches in the town. Although not every one is of architectural merit, says Dr Kaye, there are places of worship of every faith where any delegate would be welcome.

There are also at least three historic public houses with well-kept beer, interesting rooms, and decent food around the corner from the conference venue. The School of Geography, the venue of the scientific meetings, once a family residence, is now the comfortable and well-equipped home of one of the largest and most active geography departments in the UK. The School is two minutes away from the homely and comfortable conference accommodation at Oxford University's Mansfield College, and no more than five minutes from the Parks, the Science Area, the rivers (where punts can be hired) and the colleges, museums and galleries of the city centre.

A programme for accompanying persons will be arranged, and post-conference excursions can be planned if numbers permit. The climate is usually temperate in September, cool evenings preceded by daytime temperatures between 17–20°C, with little rainfall. (Given the dominance of the oceanic climate over this inland town, a standard disclaimer may be taken as read, and umbrellas recommended.)

The registration fees are GBP 150.00 until 15 August 1994; after which the fee is GBP 175.00, exclusive of accommodation. IUPAC affiliates are reminded that they are entitled to a 10% discount; in addition, with documentation, post-doctoral holders of short-term appointments and postgraduate students will be given a 25% discount off the basic registration fee until 30 August 1994.

Abstracts, with a non-refundable deposit of GBP 45.00 for accommodation and registration, should be sent as soon as possible for those wishing to submit their work for possible publication. A programme and registration form with a full statement of charges (some of which may be lowered at a later date) will be sent upon request to the Principal Organizer. This meeting should be *plein de douceur de vivre*, and intellectually challenging: the organizers look forward to welcoming IUPAC delegates in September.

Workshop on the Yenisei River

An International Workshop on the Ecology of Great Rivers of the World will be held aboard a boat cruising up and down the Yenisei River, Russia in August 1994. The theme of the workshop is 'Problems and perspectives of complex study on the way to ecological-economical optimization of water use'.

The itinerary of this 10-day workshop-cruise along Russia's longest river is Krasnoyarsk–Dudinka–Krasnoyarsk. The river crosses Siberian forests and tundra as it flows towards the Arctic Ocean.

For further information, please contact: Dr Michail Gladyshev, Secretary, Institute of Biophysics, Russian Academy of Sciences, Siberian Branch, Krasnoyarsk, 660036 Russia. Tel.: +7 (3912) 434 623 or +7 (3912) 495 642. Fax: +7 (3912) 222 556. E-mail: biolum@ibp.krasnoyarsk.su

The Yenisei flows through Siberian forests.

Chromatography

The 20th International Symposium on Chromatography will be held at the Bournemouth International Centre, Bournemouth, UK, on 19–24 June 1994. The Symposium programme will highlight recent advances in fundamental aspects of separation science and their industrial applications.

Registration and accommodation forms from: 20th ISC, Carefree Travel (International) Ltd, 122 Knightsbridge, London SW1X 7PG. Tel.: +44 (71) 589 0016. Fax: +44 (71) 581 0955.

Global Forum '94

Global Forum '94, the direct inheritor of the '92 Global Forum held in Rio de Janeiro, Brazil, at the time of the Earth Summit, will be held in Manchester, UK, from 24 June to 3 July 1994. Its overall theme and focus will be 'Cities and Sustainable Development'.

This event has four major components: (i) a Core Meeting of 900 representatives from 50 cities (65% from the developing countries) which will examine and develop action plans in respect of seven key urban issues; (ii) a series of six sectorial meetings (women, youth, local authorities, business and industry, citizen groups, and trade unions), which, over the ten days of the Forum, will examine the same seven key issues from the perspective of their individual sector; (iii) a large number of guest meetings organized by local, national and international groups; and (iv) the Manchester Public Forum, which is designed to provide an opportunity for the UK public from the North West, and elsewhere, to interface with the national and international community expected to be present in Manchester, through an Open Speakers Forum, a Global Market, a series of Special Exhibitions and a ten-day ongoing cultural programme.

For further information, contact: Global Forum '94 Secretariat, PO Box 532, Town Hall, Manchester M60 2LA, UK. Tel.: +44 (61) 236 0868/234 3741, Fax: +44 (61) 234 3743.

Conference Calendar

1994

Pesticide chemistry

4–9 July
8th International Congress of Pesticide Chemistry. Washington, DC, USA.
Dr. J. R. Plimmer, ABC Laboratories, 7200 ABC Lane, PO Box 1097, Columbia, MO 65205, USA.

Inorganic membranes

10–14 July
3rd International Conference on Inorganic Membranes. Worcester, MA, USA.
Prof. Y. H. Ma, Department of Chemical Engineering, Worcester Polytechnic Institute, 100 Institute Road, Worcester, MA 01609-2280, USA.

Macromolecules

11–15 July
35th International Symposium on Macromolecules. Ohio, USA.
Macroakron'94, Cathy Manus-Gray, Symposium Coordinator, Institute of Polymer Science, The University of Akron, Akron, OH 44325-3909, USA. Tel: +1 (216) 9725334. Fax: +1 (216) 9725463. E-Mail: Manusgray@UAkron.

Chemical thermodynamics

17–22 July
13th International Conference on Chemical Thermodynamics. Clermont-Ferrand, France.
Prof. J.-P. E. Grolier, Laboratoire de Thermodynamique et Génie Chimique, Université Blaise Pascal, Clermont-Ferrand, F-63177 Aubière Cédex, France. Tel: +33 73407186. Fax: +33 73407185.

Carbohydrates

17–22 July
17th International Carbohydrate Symposium. Ottawa, Canada.
Dr. H. Jennings, Institute of Biological Sciences, National Research Council of Canada, 100 Sussex Drive, Ottawa, Ontario, Canada, K1A OR6.

Photochemistry

17–22 July
15th IUPAC Symposium on Photochemistry. Prague, Czech Republic.
Prof. I. Stibor, Prague Institute of Chemical Technology (PICT), Department or Organic Chemistry, Technická 5, 166 28 Prague 6, Czech Republic. Tel: +42 (2) 3111790. Fax: +42 (2) 3119919. E-mail: stibori@vscht.cs

Excitonic processes in condensed matters

19–22 July
International Conference on Excitonic Processes in Condensed Matters. Darwin, Australia.
Dr. J. Singh, EXCON 94, Faculty of Science, Northern Territory University, P.O. Box 40146, Casuarina, NT 0811, Australia. Tel: +61 (89) 466811. Fax: +61 (89) 410460. E-mail: singhjai@darwin.ntu.edu.au.

How to apply for IUPAC sponsorship

To apply for IUPAC sponsorship, conference organizers should write to the IUPAC Secretariat (see inside back cover for address) requesting an Advanced Information Questionnaire (AIQ). Completed AIQs should be returned to the Secretariat preferably 2 YEARS and at least 12 months before the conference. Late applications will not be considered. Further information on granting of IUPAC sponsorship was published in *Chem. Intl.* **14**, 203 (1992).

Local air pollution

20–21 July 1994
International Workshop on Local Air Pollution in Rapidly Developing Countries. Zhen De, Beijing, China.
Prof. Xiaoyan Tang, Center of Environmental Sciences, Peking University, Beijing 100871, China. Tel: +86 (1) 2501925. Fax: +86 (1) 2501927. E-mail: TangXY@BEPC2@SCS.SLAC.STANFORD.EDU.

Coordination chemistry

24–29 July
30th International Conference on Coordination Chemistry.
Kyoto, Japan.
Prof. H. Ohtaki, Laboratories of Coordination Chemistry, Institute for Molecular Science, Myodaiji-cho, Okazaki 444, Japan.

Polymer networks 94

25–29 July
35th Microsymposium on Macromolecules.
Prague, Czech Republic.
35th Microsymposium, P.M.M. Secretariat, c/o Institute of Macromolecular Chemistry, Academy of Sciences of the Czech Republic, Heyrovsky Sq. 2, 162 06 Prague 6, Czech Republic. Tel: +42 (2) 360341. Fax: +42 (2) 367981. E-mail: SYMPO@IMC.CAS.CZ. Telex: 122019 imcp c.

Chemical education

8–12 August
13th International Conference on Chemical Education. Chemistry: The Key to the Future.
Puerto Rico.
Dr Ram S. Lamba, Metropolitan Campus, Inter American University of Puerto Rico, PO Box 191293, San Juan, PR 00919-1293, Puerto Rico. Tel: +1809 250 8379. Fax: +1809 765 2055 or +1 809 250 0782.

Raman spectroscopy

22–26 August
14th International Conference on Raman Spectroscopy. Hong Kong.
Prof. Nai-Teng Yu, Department of Chemistry, The Hong Kong University of Science & Technology, Clear Water Bay, Kowloon, Hong Kong. Tel: +852 3587358. Fax: +852 3581594. E-mail: ICORS@USTHK.BITNET

Solubility phenomena

22–26 August
6th International Symposium on Solubility Phenomena.
Buenos Aires, Argentina.
Dr Angela F. Danil de Namor, Department of Chemistry, University of Surrey, Guildford, Surrey, UK. Tel: +44 (483) 300800, ext. 2588. Fax: +44 (483) 300803.

Physical organic chemistry

28 August – 2 September
12th International Conference on Physical Organic Chemistry.
Padova, Italy.
Prof. F. Di Furia, Department of Organic Chemistry, Via Marzolo 1, I-35131 Padova, Italy. Tel: +39 (49) 831297. Fax: +39 (49) 831222. E-mail POC12@CHOROO.UNIPD.IT.

Macrocyclic ligands

29 August – 1 September
2nd International Symposium on Macrocyclic Ligands for the Design of New Materials.
Buenos Aires, Argentina.
Dr. Angela F. Danil de Namor, Department of Chemistry, University of Surrey, Guildford, Surrey GU2 5XH. Tel: +44 (483) 300800, ext. 2588. Fax: +44 (483) 300803.

Liquid crystal polymers

6–9 September
International Conference on Liquid Crystal Polymers. Beijing, China.
Prof. Xibai Qiu, Chinese Chemical Society, PO Box 2709, Beijing 100080, China.

Thermal analysis and calorimetry

11–16 September
6th European Symposium on Thermal Analysis and Calorimetry (ESTAC).
Grado, Italy.
Prof. A. Cesàro, Dipartimento di Biochimica, Biofisica E, Chimica Delle Macromolecole, Via Valerio 22, I-34127 Trieste, Italy.

Geotoxicology

18–22 September
International Conference on Geotoxicology: Mutagens and Clastogens in the Environment.
Oxford, UK.
Dr Katherine J. Kaye, School of Geography, University of Oxford, Mansfield Road, Oxford, OX1 3TB, UK. Tel: +44 (865) 271929. Fax: +44 (865) 271929

Medicinal chemistry

19–23 September
13th International Symposium on Medicinal Chemistry. Paris, France.
Administrative Secretariat, Convergences – ISMC '94, 120 avenue Gambetta, 75020 Paris, France. Fax: +33 (1) 40310165. Telex: 216911F.

Molecular mobility and order in polymer systems

3–6 October
International Symposium on Molecular Mobility and Order in Polymer Systems. St. Petersburg, Russia.
Prof. A. A. Darinskii, Institute of Macromolecular Compounds, Russian Academy of Sciences, Bolshoy pr. 31, St. Petersburg, 199004 Russia.

Functional & high performance polymers

14–16 November 1994
International Symposium on Functional & High Performance Polymers.
Taipei, Taiwan, P. R. China.
Prof. Leo-Wang Chen, National Taiwan University, Department of Chemical Engineering, Taipei, Taiwan, People's Republic of China.

Organic synthesis

11–16 December
10th International Conference on Organic Synthesis. Bangalore, India.
Prof. G. S. R. Subba Rao, (Secretary, ICOS-10), Department of Organic Chemistry, Indian Institute of Science, Bangalore 560 012, India.

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The International Union of Pure and Applied Chemistry (IUPAC), formed in 1919, is a voluntary non-governmental, non-profit association of organizations, each of which represents the chemists of a member country.

Its objectives are:

- to promote continuing co-operation among the chemists of the member countries;
- to study topics of international importance to pure and applied chemistry which need regulation, standardization, or codification;
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0193-6484(199405)16:3;1-E

Printed in England by Honey Press Ltd. (Banbury)

ISSN 0193-6484

Chemistry International

The news magazine of the International Union of Pure and Applied Chemistry (IUPAC)

IUPAC

1994, Vol. 16. No. 4 (July)

Blackwell Scientific Publications

Chemistry International

The news magazine of the International Union of Pure and Applied Chemistry (IUPAC)

EDITOR: Michael Freemantle
SECRETARIAL ASSISTANTS: Mary Patterson and Katie Smith
PRODUCTION EDITOR: Martin Clutterbuck

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Six issues of *Chemistry International* will be published bimonthly in 1994. The 1994 subscription rate including postage is GBP 58.00 (UK and overseas except North America) or USD 91.00 (US and Canada). The individual subscription rate is GBP 27.50 (UK and overseas except North America) or USD 39.50 (US and Canada). Microfiche subscriptions are available simultaneously with the printed edition, and microfilm at the end of the subscription year. Subscription orders may be placed directly with IUPAC's official publisher, Blackwell Scientific Publications Ltd, PO Box 88, Oxford, UK.

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Despatch. The news magazine is despatched within Europe by surface mail, to other continents by various forms of air-speeded delivery: to the US* by air freight for forwarding by second-class post, to India by air freight for guaranteeed local delivery, and to all other countries by Accelerated Surface Post.

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Front cover: One of the numerous quality control tests carried out at Roche. (*Photo Roche.*)

International Union of Pure and Applied Chemistry

Replacing gram-equivalents and normalities

Tom Cvitaš and Ian Mills explain why equivalent, equivalent weight, and the normality of a solution as a measure of concentration, are ambiguous and out-dated.

The equivalent (also sometimes called the gram-equivalent or val) is a concept developed more than 100 years ago for measuring the amount of a substance.[1] The equivalent is used to describe an amount of substance equal to the fraction $(1/z^*)$ of a mole, where z^* is the 'valency' of the entity used to define the mole. Thus in an acid/base titration, one equivalent of H_2SO_4 would be half a mole of the entity H_2SO_4, because H_2SO_4 is a dibasic acid, whereas one equivalent of HNO_3 would be one mole of the entity HNO_3 because HNO_3 is a monobasic acid. The concept is also used in oxidation/reduction reactions, where z^* is taken to be the number of electrons transferred by the oxidizing or reducing agent, as described in examples below.

Similarly the equivalent weight is defined as $(1/z^*) \times$ the molecular weight (or relative molar mass) M_r, and the normality of a solution is defined as a concentration equal to $(1/z^*) \times$ the molarity (so that normality is concentration in equivalents per litre just as molarity is concentration in moles per litre).

It is the purpose of this note to show that the equivalent, equivalent weight, and the normality of a solution as a measure of concentration, are ambiguous and out-dated concepts, which are displaced in the language of modern chemistry by the mole, the molecular weight, and the concentration in mole/litre.

The basic idea of the equivalent is that all reactions involve equal chemical amounts (i.e. equal amounts of substance) of reactants when amount is measured in equivalents, or equal volumes of solution when titrating solutions of equal normality. However, difficulties arise because chemistry is not that simple: the meaning of 'one equivalent' of a specified chemical may depend on the reaction involved, so that there is no unique definition of an equivalent, nor of what is meant by a normal solution. For example, the iodate ion IO_3^- acts as an oxidizing agent in dilute acid according to the reaction.

$$IO_3^- + 6H^+ + 5e^- = (1/2)I_2 + 3H_2O \qquad (1)$$

In the language of modern chemistry, the term 'normality' is replaced by mole/litre as a measure of concentration of a solution.

implying that $z^* = 5$ and hence that one equivalent of IO_3^- is equal to (1/5) of a mole of IO_3^-. However, in strong HCl, IO_3^- acts as an oxidizing agent according to the reaction

$$IO_3^- + 6H^+ + 4e^- = I^+ + 3H_2O \qquad (2)$$

(where I^+ exists as ICl_2^- in strong HCl), implying that $z^* = 4$ and that one equivalent of iodate is equal to (1/4) of a mole of IO_3^-. There are many examples of a similar nature, so that the use of equivalents is likely to cause misunderstanding and ambiguity.

The solution to these problems lies in the use of the mole as a unit of chemical amount (amount of substance). The mole is the SI unit of chemical amount, as discussed in the IUPAC Green Book.[2] The chemical amount n_B of entities B is defined as proportional to the number of entities, N_B:

$$n_B = N_B/L \qquad (3)$$

where L is the Avogadro constant, approximately equal to 6.022×10^{23} mol^{-1}. It is important to note that just as the number of entities has no meaning when the entity is not defined, so also chemical amount is meaningless when the entity is not defined. The entity may be any countable object such as an atom, ion, molecule or specified group of atoms. Thus we can say that the amount of phosphorus atoms in the sample 1 is 8 moles or that the amount of P_4 molecules in the same sample is 2 moles. In symbols:

$$n_1(P) = 8\ \text{mol}, \qquad n_1(P_4) = 2\ \text{mol}$$

The expression 'amount of phosphorus in sample 1' is, of course, ambiguous, without some definition of the entity. For the same reason nobody would say the number of phosphorus in sample 1.

It is thus essential to specify the entity whenever the mole is used as a unit. However, we may choose the entity as may be convenient. Thus in a particular case we may take the entity of sulphuric acid to be $(1/2)H_2SO_4$, because we are

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concerned with a reaction in which it acts as a dibasic acid such as:

$$(1/2)H_2SO_4 + NaOH = (1/2)Na_2SO_4 + H_2O \qquad (4)$$

Then 1 mol of $(1/2)H_2SO_4$ is just what would previously have been called one equivalent of H_2SO_4. Similarly we may take the entity of the iodate ion to be $(1/5)IO_3^-$ in reaction (1) above, but $(1/4)\ IO_3^-$ in reaction (2),

In these examples we are choosing to take the entity as the fraction $(1/z^*)$ of the molecular entity, where z^* is the **equivalent number** as used before in the definition of equivalent weight. Such an entity may be called an **equivalent entity**,[3] and then the amount of equivalent entities (SI unit: mole) may fully replace the previous use of equivalents. In a similar way we may take the amount concentration c_B of equivalent entities B (unit: mol/L) to be given by

$$c_B = n_B/V \qquad (5)$$

and this quantity replaces the formerly used normality. Note however, that

$$c(1/2H_2SO_4) = 2c(H_2SO_4),$$

and

$$c(1/4IO_3^-) = (4/5)\ c(1/5IO_3^-) = 4c(IO_3^-),$$

so that care is needed in converting chemical amounts and amount concentrations when the definition of the entity is changed. Further examples are given on page 46 of the 1993 edition of the IUPAC Green Book.[2]

To summarize, by always defining the entity we use and by making use of the concept of the equivalent entity, the **mole** and the unit **mol/L** (or molarity) may be used in place of the formerly used units equivalent and **normality**. Similarly **molecular weight** may be used in place of **equivalent weight**. The advantages are that in this way we use the familiar units of the SI system, and the ambiguity associated with the definition of the equivalent is avoided provided we always remember the rule that whenever we use the quantity **chemical amount** (or **amount of substance**), or its SI unit **the mole**, we must always specify the entity that we are using.

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Thermodynamic and transport properties of fluids

Bill Wakeham and
Marjorie de Reuck

This article reports on work being carried out at the IUPAC Project Centres on Thermodynamic Tables and Transport Properties at Imperial College, London, UK.

Background

The thermophysical properties of fluids (gases and liquids) are macroscopic quantities that enter the equations of thermodynamics and of continuum fluid mechanics and characterize either the state of a system of thermodynamic equilibrium or the rate of change of the state in response to non-uniform external stimuli. Among the properties that characterize the equilibrium state are the density, isobaric heat capacity and entropy, while the non-equilibrium or transport properties include the viscosity and thermal conductivity of the fluid. The value of each property is itself dependent upon the thermodynamic state of the fluid and so upon its temperature and pressure.

The thermodynamic properties of a fluid determine, for example, the change of temperature of a fluid between two equilibrium states in response to the supply of heat and the rate of heat conduction through a sample subject to a temperature gradient. For this reason the thermophysical properties of a fluid are involved in any scientific or industrial process in which fluids are transported, mixed or heated; that is, in most manufacturing processes.

Perhaps the simplest example of the importance of the thermophysical properties of fluids is provided by the transport of a fluid from one point to another through a pipeline. It is generally only possible to measure the volumetric flow rate of the fluid yet what is of most importance for any process using the fluid as well as from an economic standpoint is the mass flow rate. The density of the fluid, which connects the two values, must therefore be known at the conditions (pressure and temperature) of the measurement. Since it is evidently not straightforward to conduct a measurement of the density of the fluid each time a flow rate is to be determined and because statistical mechanics still does not allow us to calculate the density of the fluid from first principles, it must be obtained from an interpolation of series of measurements performed independently.

History reveals that attempts over 100 years or more to measure a quantity as conceptually simple as density have led to different results emanating from different laboratories. For other properties the differences are even more pronounced than for density amounting to as much as a factor of ten for the viscosity of some fluids.

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> 'History reveals that attempts over 100 years or more to measure a quantity as conceptually simple as density have led to different results emanating from different laboratories.'

Aside from any scientific motivation to ensure correct and consistent results for the values of the thermophysical properties, the practical consequences of these differences can be profound since, for the simple example of the flow rate mentioned above, the differences between results for the density of a fluid, make it impossible to state unequivocally the mass flow rate of a fluid from a measurement of the volume flow rate.

As international trade in bulk chemicals has increased throughout this century the problem has become more acute because, to continue the same example, the transfer of material from one company to another, possibly across national borders, has become common place. This means that it is necessary for both parties to the trade to agree upon the mass supplied when both measure volumetric flow rate under different conditions and use different sources of information for the fluid density. Naturally, such agreement is difficult to achieve given the various vested interests and no small degree of national pride.

These and related problems, with their international dimension, were recognised in 1929 when the first International Steam Tables Conference was held in London to attempt to produce an internationally agreed set of steam tables for use in the electric power generation industry. The magnitude of this particular industry and the direct relationship between the properties of its working fluid and the efficiency of energy production meant that small improvements in the accuracy of the fluid properties led to obvious and significant economic benefits.

The set of tables produced in 1931 was the first output of a body now known as the International Association for the Properties of Water and Steam which continues to the present day to refine and improve the representation and tabulations of this most important substance.

For other bulk fluids the benefits of international agreement on the thermophysical properties were more slowly appreciated and it was not until 1963, under the chairmanship of Professor D. M. Newitt, that the IUPAC Commission on Thermodynamics and Thermochemistry inaugurated a project to prepare internationally approved tables of the thermodynamic properties of fluids. The initiation of the project was prompted by the results of a number of independent surveys of existing data for the thermodynamic properties of industrial gases which revealed large discrepancies between the values from various sources as well as significant gaps in the coverage of important ranges of thermodynamic state that were filled only by a medley of interpolations.

Bill Wakeham and Marjorie de Reuck.

At the same time IUPAC was uniquely positioned to provide both the structure and authority to endow the effort with international credibility. Accordingly, IUPAC authorised the establishment of a small Project Centre at Imperial College, London, with Dr. Selby Angus as its Scientific Director, to prepare thermodynamic tables for fluids of scientific and industrial importance that would serve as global standards.

The Centre secured funding for its activities from UK government agencies and those of some other nations and began the work which continues today. Indeed the growth of international trade in bulk chemicals and also in chemical process designs and their safety has further enhanced the need for validated, quality assured values for the thermophysical properties of a wide range of materials.

In the early days of the IUPAC Thermodynamic Tables Project Centre, the political situation was not conducive to international collaboration so that a primary focus of initial activity was to build relationships with interested organisations across the world. Thus, Professor Newitt and Dr. Angus made a large number of visits to Europe – East and West, Japan, USA and USSR, in order to establish the basis for a collective programme of work. As a result of their early efforts the Project Centre has always enjoyed fruitful world wide cooperation with university, government and industrial research centres. Aside from the obvious benefits of international input to an internationally approved output it has often been possible to initiate or encourage measurements of properties in specialised laboratories world wide to fill gaps in the existing information and to receive the results prior to publication.

Thermodynamic tables

The work of the IUPAC Thermodynamic Tables Project Centre consists of the preparation and publication of definitive values of thermodynamic properties of industrially important fluids in tables which carry an international seal of approval as representing the state of the art. Thermodynamic consistency of the tables is achieved by constructing an equation of state which is able to represent all the equilibrium thermodynamic properties, to within their experimental accuracy, over the region from the melting curve to the highest temperatures and pressures available and including the saturation curve.

This involves the collection and critical assessment of all available experimental data world wide and their correlation into a dimensionless Helmholtz energy function using statistical fitting techniques which have been developed both at the Centre and elsewhere over the years.

The fluids selected for study remain those key substances which have international importance because of the size of their market, the need for custody transfer, the protection of the environment or the need for quality assurance. For example the knowledge of the properties of coolants, such as carbon dioxide used in nuclear reactors, is required for assessing the safety of plant operation; and the properties of methane, the major component of natural gas, are of particular importance both in the design of process equipment for liquifaction, separation and transportation of natural gas and for the calibration of custody transfer instruments.

The range of fluids for which accurate data are required has changed surprisingly little over the years, but advances in technology have resulted in greater control of industrial processes and therefore a need for increasing accuracy of the data used for engineering designs. As a result the Tables and correlations for the most important fluids need complete revision about every ten to twenty years.

> 'advances in technology have resulted in greater control of industrial processes and therefore a need for increasing accuracy of the data used for engineering designs.'

For some fluids the equations of state have been developed by research groups other than the Centre but for all of them the Centre is responsible for the entire production of the volumes in the series of *International Thermodynamic Tables of the Fluid State*. This includes the editing of the text, the compilation of the tables which represent 14 related thermodynamic properties in the single phase as well as their values at saturation. The text and tables are now typeset by the Centre using the software package $\TeX$. We have written special computer programs which automatically convert the computer generated tables, which occupy some two thirds of each book, into $\TeX$ output thus avoiding the necessity to proof read the numbers. For the majority of the volumes the text is also written by the Centre, but there are a few volumes where the authorship has been shared with international collaborators.

International collaboration has been at the heart of the success of the IUPAC Thermodynamic Tables Project Centre for many years and we attach great importance to maintaining links with many countries including the Czech Republic, Germany, Japan, Netherlands, Russia, Ukraine and USA, as well as establishing new links such as the collaboration that we are just beginning with Bulgaria.

Transport properties

Although the possibility of including non-equilibrium or transport properties within the original Thermodynamics Centre was discussed at the time of its foundation, it was not until 1981 that a Subcommittee on Transport Properties was formed by the Commission on Thermodynamics under the chairmanship of Professor Joseph Kestin. The Transport Properties Project Centre was established at Imperial College in 1983 with funding largely provided by the UK Department of Trade and Industry with some industrial support. At that time Dr. Selby Angus retired from his position as Scientific Director of the Thermodynamics Tables Project Centre and the authors took over the operation of the two Centres.

The Subcommittee on Transport Properties was formed to do for these properties what had been so successful for the thermodynamic properties and for similar reasons. That is, the aim was to produce internationally agreed representations of fluid transport properties such as the viscosity, thermal conductivity and diffusion coefficient over wide ranges of thermodynamic state. This is achieved by means of a critical evaluation of experimental information combined with judicious use of statistical mechanical theory which provides more guidance than for the equilibrium properties. Finally a single equation representing each transport property is determined by means of the same statistical procedures as for the Thermodynamic Tables Project Centre.

Notwithstanding the similarity of purpose between the two Project Centres the Subcommittee on Transport Properties has adopted a different mode of operation for its Project Cen-

Industrial gases plant. (*Photo courtesy BOC Process Plants.*)

tre. Firstly, the international effort has been distributed more widely among collaborating laboratories in Australia, Germany, Greece, Japan, Netherlands, Norway, Portugal, Russia, Singapore, and USA with the Project Centre as a coordinator and performing only part of the work. Secondly, the output of activities of the Subcommittee does not lend itself to publication in books so that the *Journal of Physical and Chemical Reference Data* has usually been preferred as a medium of publication. The Subcommittee has so far amassed a total of more than fifty articles dealing with the representation of transport properties and with standard reference values of which a few are included in the bibliography given below.

Computer packages

In the very earliest days of the compilation of thermodynamic data the results were presented in the form of large charts and most of the correlations were performed graphically. By the time the first Project Centre was working in London the preparation of the results could be performed with computers but it was usual to provide tabulations of the evaluated properties within which linear interpolation was possible.

By the early 1980s users were no longer satisfied with making their own linear interpolations into the tables of properties but wanted to be able to calculate them directly from the equations of state. The representative equations of state were often so complicated that users were reluctant to develop their own computer codes and so we developed our first computer package. It contained accurate equations of state for 7 fluids and, given values of pressure and temperature, it would return values for the equilibrium properties in both the single and two phase regions.

Since then the package has been expanded to include 19 fluids, transport properties have been added which are thermodynamically consistent with the equilibrium properties and the computation time has been greatly reduced. Our most recent extension of the package is to use the very accurate equations of state for the pure fluids to predict the properties of selected mixtures using the ‘two fluid’ corresponding states model.

The package is marketed by the Physical Property Data Service (PPDS) which was originally operated by the Institution of Chemical Engineers of the UK and is now the responsibility of the UK National Engineering Laboratory Executive Agency in East Kilbride, Scotland.

Financial support

The excellent international co-operation which we have enjoyed over the years means that very large contributions in kind have been received, usually in the form of expensive experimental programmes of work, which have given us access to data well before publication. However, acquiring the more modest adequate financial support for the Centres themselves, has been a continual problem since the beginning and remains so today.

Over the years contributions have been received from industrial companies such as Air Liquide, BOC, BP, ICI, Shell Research, and Sulzer Bros.; and also from the Academy of Sciences of the USSR, the National Science Foundation and the National Institute of Standards and Technology of the USA, the Volkswagen Stiftung of the BRD, the Centre National Recherche Scientifique of France and the Swedish Technical Research Council. But the major share of the support for the staff of the Centres has been provided by various Departments of the United Kingdom Government and at present comes from the Department of Trade and Industry. The Thermodynamics Centre receives part of the royalties on the books which it publishes and is overall a net contributor to IUPAC funds. Some additional revenue comes from the sale of the computer packages developed by the Centres.

Imperial College, London.

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A Guide to IUPAC Nomenclature of Organic Compounds

The recently published *Guide to IUPAC Nomenclature of Organic Compounds* updates the set of rules contained in the 1979 edition of *Nomenclature of Organic Chemistry* and enables a user to fit a name to a particular need.

The *Guide to IUPAC Nomenclature of Organic Compounds, Recommendations 1993* includes published and hitherto unpublished revisions to the 1979 edition of *Nomenclature of Organic Chemistry* (the Blue Book). The Guide was prepared for publication, on behalf of the IUPAC Organic Chemistry Division, Commission on Nomenclature of Organic Chemistry (III.1), by R. Panico, W. H. Powell and Jean Claude Richer (Senior Editor).

Commission III.1 Chairman Henri Favre comments that 'the publication of the Guide does not make the Blue Book completely obsolete. The Blue Book is however no longer the reference document. Chemists and other practitioners of organic nomenclature must start using the Guide. The Commission is actively working on P names, with reference to the Guide. From now on, publications by the Commission will complement and explain this document. This is another reason to avoid giving the impression that the Blue Book may still be the major source of reference, in spite of what outstanding nomenclaturists may think.'

The following introduction is the 'Preamble' to the Guide:

The main purpose of chemical nomenclature is to identify a chemical species by means of written or spoken works. To be useful for *communication* among chemists, nomenclature for chemical compounds should additionally contain within itself an explicit or implied relationship to the structure of the compound, in order that the reader or listener can deduce the structure (and thus the identity) from the name. This purpose requires a system of principles and rules, the application of which gives rise to a systematic nomenclature (for examples, see the 1979 Edition of the IUPAC *Nomenclature of Organic Chemistry*)[1].

In contrast to such systematic names, there are traditional names, semisystematic or trivial, which are widely used for a core group of common compounds. Examples are 'acetic acid', 'benzene', 'cholesterol', 'styrene', 'formaldehyde', 'water', 'iron'. Many of these names are also part of general nonscientific language and are thus not confined to use within the science of chemistry. They are useful, and in many cases indispensable (consider the alternative systemic name for cholesterol, for example). Little is to be gained, and certainly much to be lost, by replacing such names. Therefore where they meet the requirements of utility and precision, and can be expected to continue to be widely used by chemists and others, they are retained and, for the most part, preferred in this Guide.

Semisystematic names also exist, such as 'methane', 'propanol', and 'benzoic acid', which are so familiar that few chemists realize that they are not fully systematic. They are retained, and indeed, in some cases there are no better systematic alternatives.

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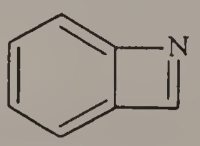
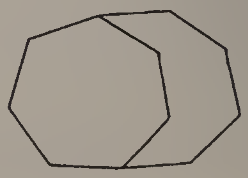
R-8 Isotopically modified compounds
R-9 Appendix

It is important to recognize that the rules of systematic nomenclature need not necessarily lead to a unique name for each compound, but must always lead to an unambiguous one. Lucidity in communication often requires that the rules be applied with different priorities. A comparative discussion of the compounds $CH_3{-}CH{=}CH_2$, $Cl{-}CH_2{-}CH = CH_2$, $C_6H_5{-}CH_2{-}CH{=}CH_2$, $H_2N{-}CH_2{-}HC{=}CH_2$ and $HO{-}CH_2{-}CH{=}CH_2$, might be easier to follow if they were all named as propenes, even though with the last three, the benzene ring, amino, and hydroxy groups may have seniority over the double bond for citation as a parent or as a suffix. In other cases, a set of rules that generates clear and efficient names for some compounds can lead to clumsy and nearly unrecognizable names for others, even closely related ones. To force the naming of all compounds into the Procrustean bed of one set of rules would not serve the needs of general communication, and the Commission believes that the majority of organic chemists would not accept such a policy for general communication. This situation can be illustrated by a compound that most chemists would probably name as 'pentaphenylethane', instinctively, whereas the application of a principle favouring rings over chains leads to a name such as 'ethanepentaylpentabenzene'. The first name is certainly more easily recognized than the second. Another example is compound (**1**) which would be named 'benzoazete' by application of fusion nomenclature principles, but von Baeyer nomenclature could give the name '7-azabicyclo[4.2.0] octa-1,3,5,7-tetraene'. On the other hand, von Baeyer nomenclature is most useful with compounds such as 'bicyclo [4.3.2] undecane' (**2**).



(1)



(2)

In view of the foregoing considerations, this *Guide to IUPAC Nomenclature of Organic Compounds* often presents alternative sets of rules, equally systematic, wherever available and justifiable, to enable a user to fit the name to a particular need.

Lastly, the Commission recognizes that for certain types of compounds, there is significant disagreement among chemists in different fields as to what should be the preferred nomenclature. This situation leads to an apparent lack of decisiveness in some of the recommendations in this document. This is unavoidable, because long experience has taught that formulating rules not having general support is a futile exercise; such rules will be widely ignored. Therefore, the Commission's policy is to offer critically examined alternatives, some of which may be new proposals, and to observe how they are accepted and used. If one of the alternatives subsequently becomes preferred to an overwhelming extent by the community of chemists, a future edition of recommendations can reflect that fact.

In this Guide, some practices of the Chemical Abstracts Service and/or of the Beilstein Institute have been mentioned. This is done only for informational purposes, and such instances are not necessarily recommendations of the Commission. The Commission recognize that there are circumstances that require a preferred (i.e. unique) name. These include comprehensive indexing (such as for the volume indexes to *Chemical Abstracts*) in order to avoid an intolerable amount of cross-checking and multiple entries. The need is being met in a particular way by Chemical Abstracts Service as in-house procedures designed to place compounds with the same parent skeleton together while at the same time minimizing the number of rules. The *Chemical Abstracts Index Guide* treats the majority of compounds, but is not complete. There are a number of other in-house procedures applies elsewhere, such as in Beilstein[2] (not yet explicitly published). Specialty files, such as steroids and carbohydrates, have different bases. The result Is not always compatible with ease of recognition, ease of generation, or conciseness. Unique names are also very important in legal situations, with manifestations in patients, export–import regulations, health and safety information, etc. These needs are being addressed by other Commission projects. In this Guide, the primary aim is to provide directions for arriving at an unambiguous name, although some guidance is given about establishing preferences.

The rules given in the *Nomenclature of Organic Chemistry*,[1] commonly known as the 'Blue Book', emphasize the generation of unambiguous names in accord with the historical development of the subject, because the need for a 'unique' name was not perceived to be compelling by earlier generations of chemists. The so-called information explosion of recent decades is a major factor in changing this perception. The present matrix of rules, however, cannot easily be overlaid with a simple set of principles for selecting a preferred name among the systematic alternatives, and to declare a preference by arbitrary fiat in each situation would surely lead to widespread rejection. Therefore, the Commission has initiated projects to formulate a comprehensive guide for selecting unique names that will, insofar as feasible, have good recognition value and a general acceptance among chemists; the results will be presented in later publications. Further projects, with longer-range objectives of systematizing nomenclature of organic compounds, are also under way.

Finally, those who use this Guide should be aware that the nomenclature in these recommendations is independent of the orientation of the graphic structure (except as stated in the recommendations for nomenclature of fused-ring structures) and of conformation. Furthermore, the nomenclature does not indicate nor imply an electronic structure or spin multiplicity.

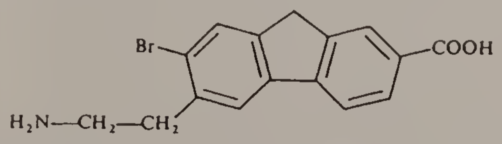
References

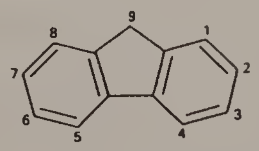
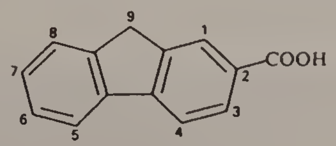
1 International Union of Pure and Applied Chemistry, Organic Chemistry Division, Commission on Nomenclature of Organic Chemistry, *Nomenclature of Organic Chemistry, A, B, C, D, E, F, and H,* 1979 Edition, J. Rigaudy and S. P. Klesney, eds, Pergamon Press, Oxford, 1979, 559 pp.

2 *Beilsteins Handbuch der Organischen Chemie,* Springer Verlag, Berlin.

A Guide to IUPAC Nomenclature of Organic Compounds *is edited by R. Panico, W. H. Powell and J. C. Richer and published by Blackwell Scientific Publications, Oxford, UK, 1994. xv + 190 pp. ISBN 0 632 03488 2. Price: GBP 16.95/USD 25.00. Affiliate Members discount price: GBP 10.20/USD 15.00.*

Example: how to construct the name of a compound



Principal group:	–COOH	-carboxylic acid
Parent hydride:		9*H*-Fluorene
Parent hydride + principal group:		9*H*-Fluorene-2-carboxylic acid
Substituents:	–Br	Bromo-
	$-CH_2-CH_2-NH_2$	
Secondary parent substituent:	$-\underset{1}{CH_2}-\underset{2}{CH_3}$	Ethyl-
Substituent:	$-NH_2$	Amino-
Secondary substituent name:		2-Aminoethyl-

Compound name: 6-(2-Aminoethyl)-7-bromo-9*H*-fluorene-2-carboxylic acid

PAC Review

Pure and Applied Chemistry (*PAC*) is IUPAC's official journal. It publishes the main invited lectures of symposia sponsored by the Union; the recommendations of its Commissions on nomenclature, symbols and units, and technical reports on standardization, recommended procedures, collaborative studies and data compilations. Summaries of the most recent IUPAC recommendations on nomenclature and symbols, and technical reports appearing in *PAC* are published in *Chem. Intl.* in the section Recent Reports. In this section we take a brief look at the symposia and lectures published in recent issues of *PAC*.

Chemistry of cataracts

Cataract is an opaque condition of the lens of the eye. Senile cataract is responsible for significant visual impairment in old people worldwide. It is generally accepted that there are several risk factors leading to the loss of lens transparency. These include diabetes, malnutrition, drugs, radiation and diarrhoea.

Transparency of the lens depends on a unique arrangement of tightly packed fibres which in turn rely on certain structures. These proteins, the crystallins, are thus responsible for establishing remarkable optical properties of the lens. The determination of the role of crystallins in the process of opacification requires a detailed study of their structure, environment, mode of interaction and individual and collective behaviour in cataractogenesis.

A paper published in the January 1994 issue of *Pure Appl. Chem.* reports on up to date research on senile cataract lenses including studies on aqueous humour, comparative profiles of different stages of cataract development and structural studies on crystallins. The paper, by S. Zarina, A. Abbasi and Z. H. Zaidi (University of Karachi, Pakistan) was one of the plenary lectures presented at the 3rd International Symposium on Protein Structure Function Relationship held in Karachi, Pakistan, 9–12 January 1993.

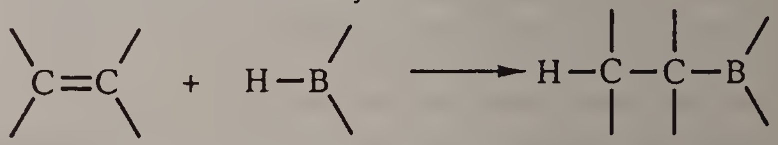
Other papers presented at the symposium and published in the January issue of *Pure Appl. Chem.* include:

- 'Targeting enzyme sites in pyruvate kinase, glutamate dehydrogenase and glutathione S transferase' by Roberta F. Colman (University of Delaware, USA).
- 'Structural biology of high molecular weight kininogen' by Robert W. Colman (Temple University School of Medicine, Philadelphia, USA).
- 'X ray structural studies of some metalloproteins' by S. Samar Hasnain (SERC Daresbury Laboratory, Warrington, UK).
- 'Structure function relationship of trichosanthin' by Pan Kezhen *et al.* (Fujian Institute of Research on the Structure of Matter, China).
- 'Interaction of *Aspergillus niger* catalase with sodium *N* dodecyl sulphate' by Ali A. Moosavi Movahedi (University of Tehran, Iran).
- 'HIV transmembrane glycoprotein GP41 ENV fragments with high antigenicity and their application to determine HIV positive sera' by Stanka Stoeva *et al.* (*Abteilung* für Physikalische Biochemie der Universität Tübingen, Germany).
- 'Structural analysis of proteins in Thailand: Identification of abnormal hemoglobins' by J. Svasti *et al.* (Bangkok, Thailand).

The optical properties of the lens in an eye depend on a group of proteins known as crystallins. Researchers at the University of Karachi, Pakistan are studying the role of crystallins in cataract formation.

Chiral organoboranes

'It was with serendipity that we discovered the hydroboration reaction, the remarkably facile addition of diborane in ether solvents to alkenes and alkynes:'

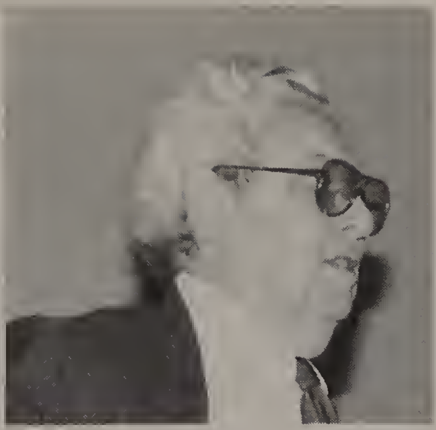


So commented IUPAC affiliate and Nobel Prize winner Herbert C. Brown (Purdue University, USA) at the beginning of his lecture on 'Recent advances in the boron route to asymmetric synthesis' presented at the IUPAC sponsored IMEBORON VIII – 8th International Meeting on Boron Chemistry, held at Knoxville, Tennesse, USA, 11 15 July 1993. His paper, coauthored with P. V. Ramachandran, was one of the 7 plenary lectures published in the February 1994 issue of *Pure Appl. Chem.*

Brown goes on to point out that 'the discovery of asymmetric hydroboration marked the beginning of practical asymmetric synthesis and a new era in organic chemistry. It began with a study of the hydroboration of α-pinene, a reaction carried out to test for possible rearrangements during the hydroboration of sensitive olefines.

> 'just another routine reaction ... turned out to be one of those grandiose reactions that is a researcher's dream.'

Brown and Ramachandran conclude that 'the reaction of α-pinene with borane, just another routine reaction during the study of the characteristics of hydroboration, turned out to be one of those grandiose reactions that is a researcher's



Herbert Brown.

dream. α-Pinene proved to be a very fortuitous choice as a chiral auxiliary for asymmetric synthesis.'

They point out that it satisfies most of the conditions that are tests for an excellent chiral auxiliary, for example:

1. Both isomers of α-pinene are readily available in high ee.
2. Optical upgradation of the commercial material is easily attained during hydroboration.
3. The preparation of the reagents and the reaction conditions in most of the reactions are very simple and convenient.
4. The workup is easy.
5. The chiral auxiliary is readily recovered in all of the reactions without loss of any optical activity in an easily recyclable form.
6. A tentative mechanism is known for all of the reactions which helps in modification, wherever necessary.
7. The configuration of the products can be predicted based on the mechanism, with rare exceptions.
8. The scaling up of the reactions are easy, and most important of all,
9. The enantiomeric excesses achieved in most reactions are very high.

Finally, Brown and Ramachandran note that enantiomeric excesses in the range >95% are obtained for the following established procedures:

- The asymmetric hydroboration of three of the four classes of olefins [the product from the fourth (Class I olefin) can be obtained indirectly *via* asymmetric homologation].
- In the general asymmetric synthesis *via* boronates and borinates obtained from hydroboration and homologation.
- In asymmetric homologation.
- In asymmetric allyl – and crotylboration.
- In asymmetric reductions.
- In asymmetric enolboration aldol reactions.
- In the cleavage of epoxides.

To their knowledge, there is no other chiral auxiliary and reaction comparable to α-pinene and its hydroboration leading to chiral organoboranes that are capable of achieving so many different types of asymmetric reactions in such high efficiency (see figure). This asymmetric synthesis *via* chiral organoboranes is truly general.

Other IMEBORON VIII papers published in the February issue of *Pure Appl. Chem.* were:

- 'New synthetic transformations via organoboron compounds' by Akira Suzuki (Hokkaido University, Japan).
- 'Some chemistry of hindered organoboranes' by Andrew Pelter (University College of Swansea, UK).
- 'Reductive mono and *trans*-α, α′-diallylation of aromatic nitrogen heterocycles by allylboranes' by Yu. N. Bubnov (N. D. Zelinsky Institute of Organic Chemistry, Moscow, Russia).
- 'Host guest chemistry of anion complexation by macrocyclic multidentate Lewis acids' by M. Frederick Hawthorne, Xiaoguang Yang, and Zhiping Zheng (University of California at Los Angeles, USA)
- 'Aza-*closo*-dodecaborane(12): The story of six coordinate nitrogen' by Peter Paetzold, Jens Müller, Franc Meyer, Hans Peter Hansen, and Lenka Schneider (Technische Hochschule Aachen, Germany).
- 'Borane osmium cluster chemistry' by S. G. Shore (The Ohio State University, USA).

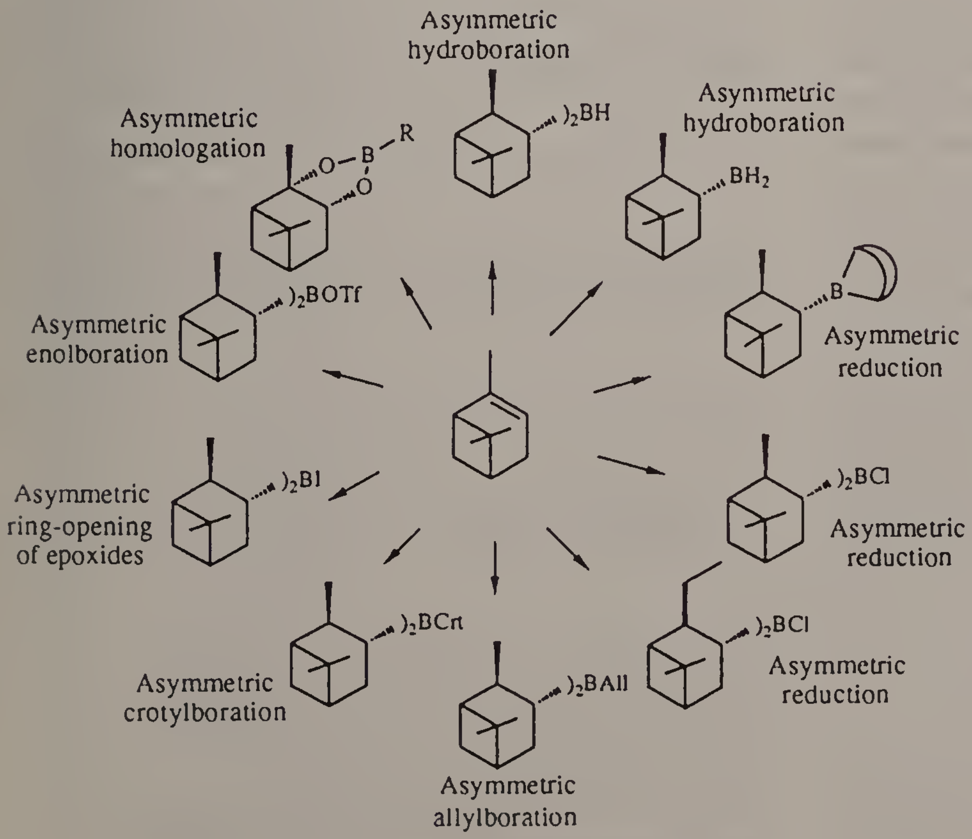


Fig. α-Pinene, the super chiral auxiliary.

Recent Reports

In this section we publish summaries of the most recent IUPAC recommendations on nomenclature and symbols and technical reports. The full texts of these recommendations and reports are published in *PAC*.

Mutual diffusion coefficients in aqueous electrolyte solutions (Technical Report)

Published mutual diffusion coefficient data for aqueous electrolyte solutions are presented in this report. Coefficients of a selected function useful for calculation of diffusion coefficient values at specified concentrations are also given.

This report was prepared for publication by Victor M. M. Lobo, Commission on Electrochemistry, Physical Chemistry Division, and published in Pure Appl. Chem, ***65**, 2613–2640 (1993).*

Kinetics of composite reactions in closed and open flow systems (IUPAC Recommendations 1993)

This paper is aimed at providing an accurate and non-ambiguous description of reaction systems occurring in closed or open systems and involving possible density changes during the reaction. Owing to its systematic character, the proposed method is well suited to implementation on the computer for quantitative calculations, as those which are required for chemical engineering applications.

The treatment proposed in this report is based on standard methods used in Chemical Reaction Engineering (CRE). Unfortunately, the notations universally accepted in the CRE community, which created the corresponding concepts, are different from those recommended in IUPAC's *Quantities, Units and Symbols in Physical Chemistry* (the 'Green Book'). This especially applies to the rate of reaction which is universally denoted r in the CRE literature instead of v, used by chemists. Related quantities such as the rate of production of species are denoted R_j(CRE) instead of r_j(IUPAC).

In order to avoid confusion among the chemist's community, the treatment in this report follows the Green Book's recommendations. However, as this report may also be used by chemical reaction engineers, a summary of the main relationships is given with CRE notations in an appendix.

This report was prepared for publication by Jacques Villermaux, Commission on Chemical Kinetics, Physical Chemistry Division, and published in Pure Appl. Chem, ***65**, 2641–2656 (1993).*

Biochemical engineering in biotechnology (Technical Report)

This report illustrates the role of biochemical engineering in biotechnology – regarded as the technology of industrial exploitation of biochemical systems. The report points out the scientific disciplines underlying biotechnology.

IUPAC Affiliate Prof. Murray Moo-Young (University of Waterloo, Canada) is a Titular Member of the Commission on Biotechnology and one of the authors of a recent IUPAC Technical Report.

Biochemical engineering is described as an established discipline, drawing upon chemical, biological and engineering sciences and concerned with design, development, implementation and operation of processes and process plant for handling biological materials and biocatalysts.

The principal aspects of bioprocessing considerations are outlined, including processing steps, biocatalysts, bioreactors and downstream processing considerations, to impart a flavour of the biochemical engineering activities and their interaction with chemical sciences (see figure).

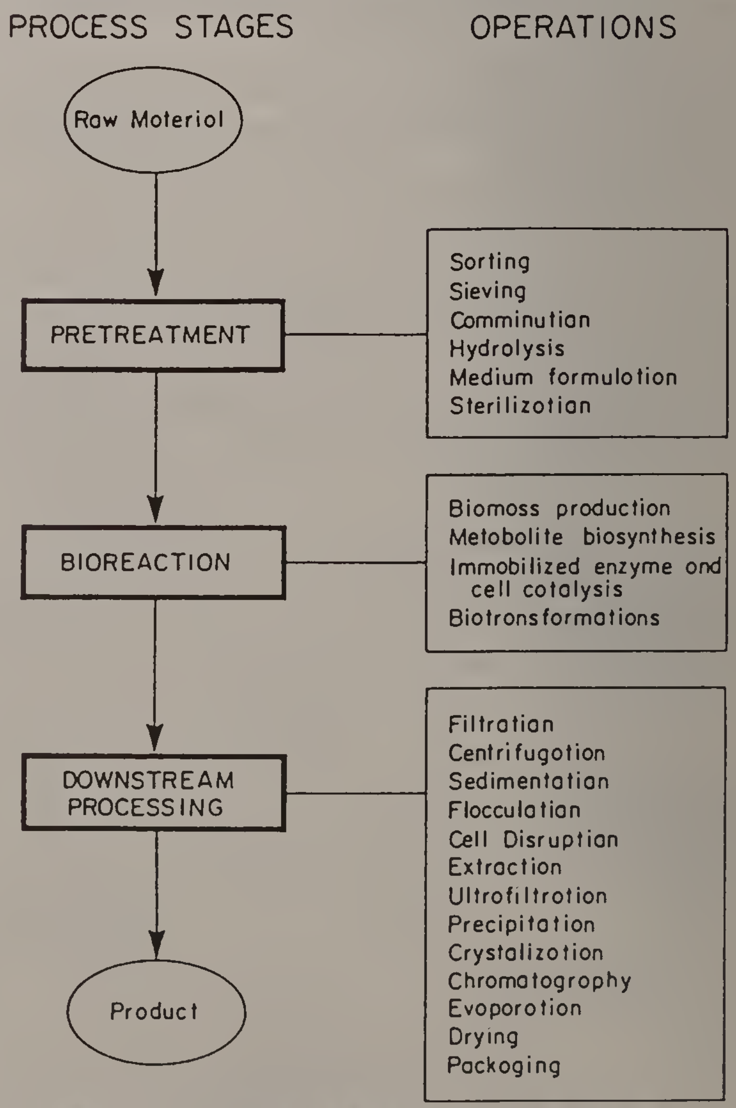

PROCESS STAGES
OPERATIONS
Raw Material
PRETREATMENT
Sorting
Sieving
Comminution
Hydrolysis
Medium formulation
Sterilization
BIOREACTION
Biomass production
Metabolite biosynthesis
Immobilized enzyme and cell catalysis
Biotransformations
DOWNSTREAM PROCESSING
Filtration
Centrifugation
Sedimentation
Flocculation
Cell Disruption
Extraction
Ultrafiltration
Precipitation
Crystalization
Chromatography
Evaporation
Drying
Packaging
Product

Figure. Bioprocess stages and unit operations.

As shown by examples, applications of bioprocessing and biochemical engineering are wide ranging, covering such major facets of civilization as health-care, agriculture and food, resource recovery, bulk and fine chemicals, energy and environmental pollution abatement.

This report is Part IV of the series on 'Interrelations of Chemistry and Biotechnology'. It was prepared for publication by M. Moo-Young and Y. Chisti, Commission on Biotechnology, Applied Chemistry Division, and published in Pure Appl. Chem, ***66**, 117–136 (1994).*

Assessment of uncertainties in the projected concentrations of methane in the atmosphere (Technical Report)

Sinks and sources of methane were examined in papers presented at a IUPAC-sponsored workshop held in Moscow in July 1992. The conclusion reached was that very large uncertainties exist in the assessment of sources. The emissions from wetlands and rice paddies could be much lower than formerly assumed. The emissions from other sources, e.g. from landfills, could be larger.

The most important sink, oxidation by OH-radicals in the atmosphere, has an uncertainty of 40% or more and cannot be used to evaluate the quality of the emission data. As a consequence, it is very difficult to predict future atmospheric concentrations, as function of changes in land use and economic activities. The prediction of the radiative balance of the earth is very difficult not only because of the uncertainty in future greenhouse gas concentrations but also because important factors, like the influence of aerosols, are insufficiently characterized.

Contents of report

Introduction (J. Slanina and P. Warneck)
- Trends in atmospheric methane (M. A. K. Khalil and R. A. Rasmussen);
- Tropospheric CH_4: uncertainties in its chemical loss rate (J. G. Calvert);
- Assessment of methane sources and their uncertainties (E. Matthews);
- Global methane emissions from biomass burning and comparison with other sources (M. O. Andreae and P. Warneck);
- Methane emissions from northern wetlands: source strength and uncertainties in estimates (N. T. Roulet and L. A. Barrie);
- Climate forcing by gases and aerosols (S. E. Schwartz) Sources of methane in Russia (N. M. Bazhin) Emissions of methane in Japan (H. Akimoto);
- Methane emission in China (X. Tang);
- Indian methane budget and its global perspective (O. N. Singh).

This report, based on Proceedings of the International Workshop held in Moscow, Russia, 20–21 July 1992, was prepared for publication by J. Slanina, P. Warneck, N. M. Bazhin, H. Akimoto and W. M. Kieskamp, Commission on Atmospheric Chemistry, Applied Chemistry Division, and published in Pure Appl. Chem, ***66**, 137–200 (1994).*

Reporting of stable hydrogen, carbon, and oxygen isotopic abundances (Technical Report)

To eliminate possible confusion in the reporting of isotopic abundances on non-corresponding scales, the Commission on Atomic Weights and Isotopic Abundances recommended at the General Assembly at Lisbon, Portugal that (I) $^2H/^1H$ relative ratios of all substances be expressed relative to VSMOW (Vienna Standard Mean Ocean Water) on a scale such that $^2H/^1H$ of SLAP (Standard Light Antarctic Precipitation) is 0.572 times that of VOMOW, (ii) $^{13}C/^{12}C$ relative ratios of all substances be expressed relative to VPDB (Vienna Peedee belemnite) on a scale such that $^{13}C/^{12}C$ of NBS 19 carbonate is 1.00195 times that of VPDB, and (iii) $^{18}O/^{16}O$ ratios of all substances be expressed relative to either VSMOW or VPDB on scales such that $^{18}O/^{16}O$ of SLAP is 0.9445 times that of VSMOW.

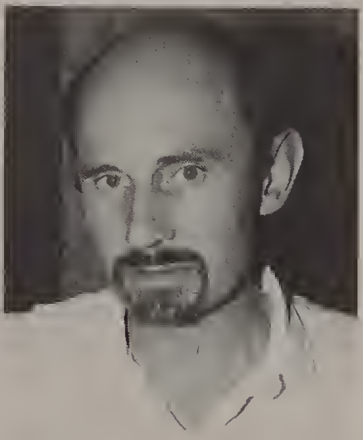
Analyte isolation by solid phase extraction (SPE) on silica-bonded phases: Classification and recommended practices (Technical Report)

This article reviews the technique of solid phase extraction (SPE) using silica bonded phases. In the first section, a classification is given of the different analyte isolation techniques and SPE is defined. An overview is given of the different kinds of sorbents available, especially focusing on the chemically bonded silica phases. Further sections deal with SPE in practice: a description of a typical extraction column, the outlines of off-line SPE, the importance of flow rate, the capacity of the sorbent and what the important factors are for method development.

Attention is paid to the different binding mechanisms in SPE as selectivity is a function of the interaction among the matrix, the analyte and the sorbent. Selectivity can be further enhanced using a combination of more than one solid phase, ion-pair SPE or solvent changeover. Furthermore the possibilities of trace enrichment and the fractionation of complex mixtures are considered. two critical points in SPE, namely the between-batch and between-manufacturer variation and the possible elution of interfering compounds from the cartridge housing are discussed. In the section on automation, a description is given of the available equipment for off-line and on-line SPE. Finally, the applications of SPE are outlined.

Applications of accelerator mass spectrometry in analysis of trace isotopes and elements (Technical Report)

Accelerator mass spectrometry (AMS) is mainly employed to measure very low concentrations of a number of long-lived radioisotopes and stable isotopes with very high sensitivities. The predominant application of AMS is in the field of geosciences and is based on chronological evaluations and dating principles. This paper deals with AMS applications other than dating problems, aiming at the analytical aspects of the trace isotopes and trace elements. It addresses non-dating applications in the fields of nuclear physics, geology, hydrology, environmental sciences which have received increasing attention. Comparison of AMS with other analytical techniques with respect to detection limits and other functions is also discussed.



Pat Holland (New Zealand) is Secretary of the Commission on Agrochemicals and was one of the authors of the 31st IUPAC Report on Pesticides.

Pesticides report 31: Effects of storage and processing on pesticide residues in plant products (Technical Report)

Residues of pesticides in food are influenced by the storage, and handling and processing that occurs between harvesting of raw agricultural commodities and consumption of prepared foodstuffs. Reviewing the extensive literature showed that in most cases these steps lead to large reductions in residue levels in the prepared food, particularly through trimming, washing and cooking operations.

Residues of post harvest insecticide treatment on stored staples such as cereal grains and oil seeds generally decline only rather slowly. However, processing into foods again results in large losses except for unrefined oils. the behaviour of residues in storage and processing can be rationalised in terms of the physico-chemical properties of the pesticide and the nature of the process. EBDC fungicides are examined in more detail as a class of fungicides of concern due to the formation of the toxic breakdown product ETU.

Recommendations are provided for the conduct of storage or processing studies on fate of pesticide residues in food so that data obtained is relevant, comparable and may be extrapolated to other situations.

Measurement of total nickel in body fluids: electrothermal atomic absorption methods and sources of preanalytic variation (Technical Report)

Before attempting to establish reference concentrations of Ni in the blood serum or plasma, a laboratory must be working comfortably at the 2 nmol/L level. To achieve this, scrupulous acid-leaching of all materials that come into contact with the sample is essential, and blood collection with non-metallic systems is advisable. A particle-free environment (clean-air laboratory) seems necessary.

Values of Ni in serum above 1.7 to 5.1 nmol/L are suspect; values in the urine of people without occupational or other unusual environmental exposures are an order of magnitude higher. For reported concentrations to be meaningful, the reference population must be thoroughly described in terms of age, sex, place of residence, occupation, diet, alcohol and tobacco use, medications and medical history, as all such factors may influence the actual concentrations of Ni.

Sampling procedures must be standardized (for instance for time of day, season, posture of the person, etc.) and reported. Storage, if necessary, should minimize opportunities for sample adulteration, and these must be evaluated empirically. Preparation of samples should also minimize processing; acidification or protein precipitation with ultrapure nitric acid are adequate for clear body fluids. Analysis by ET-AAS with Zeeman correction is the most useful approach currently available.

Provisional Recommendations

Recommendations for nomenclature in evaluation of analytical methods

This IUPAC nomenclature document has been prepared to help establish a uniform and meaningful approach to terminology, notation, and formulation for performance characteristics of the Chemical Measurement Process (CMP). Following definition of the CMP and its Performance Characteristics, the document addresses fundamental quantities related to the observed response and calibration, and the complement to the calibration function: the evaluation function.

Performance characteristics related to precision and accuracy comprise the heart of the document. These include measures for the ‘central tendency’ or mean for the relevant chemical measurements, as well as dispersion measures such as variance and standard error.

Attention is given also to very important issues involving: assumptions, internal and external quality control, uncertainty components, and bounds for systematic error. Special treatment is given to nomenclature matters concerning detection and estimation (quantification) in analytical chemistry, including attention to error propagation and the significance of the blank. The document concludes with a note on the important distinction between the Sampled Population and the Target Population, especially in relation to the interlaboratory environment.

Comments on the document are welcome and should be sent by 30 November 1994 to: Dr St Glab, Wydzial/Chemii, Uniwersytet Warszawski, u1. L. Pasteura 1, PL 02 093 Warszawa, Poland.

Publications

International Register of Materials Database Managers

The *International Register of Materials Database Managers* was set up by the CODATA Task Group on Materials Database Management as a resource to support its commitment to communicate and co-ordinate information and practices relating to this field.

The *Register* is kept in electronic form at the Head of CODATA in Paris, France. So that it may be rapidly updated as necessary it is not overburdened with detail. It is not the purpose of the *Register* to furnish contacts for users of databases; rather the entries identify those who are engaged in materials database management and related activities. It is open to all such persons without restriction as to their association with public, private, or company systems; the Task Group aims to assist all managers whatever their affiliation.

The first printed edition was issued in June 1990. The second edition corresponds with the electronic version of the *Register* as at 1st April 1993. It contains nearly 40% more names, has a wider geographical coverage, contains more extensive records of the materials databases with which many of the managers are associated, and includes more detailed indexing than the first edition. This reflects the rapid development that has taken place in the availability and use of materials databases over recent years.

CODATA is an interdisciplinary Scientific Committee of the Council of Scientific Unions (ICSU) which seeks to improve the quality, reliability, management and accessibility of data of importance to all fields of science and technology. It is concerned with all types of quantitative data resulting from experimental measurements or observations in the physical, biological, geological and astronomical sciences. monographs.

For further information on CODATA and its publications, please contact: CODATA Secretariat, 51 Boulevard de Montmorency, 75016 Paris, France. Tel: +33 (1) 45 25 04 96. Telex: ICSU 630563 F.

Effects of increased UV radiation on global ecosystems

The Scientific Committee on Problems of the Environment (SCOPE) of the International Council of Scientific Unions (ICSU) has recently published a report entitled 'Effects of Increased Ultraviolet Radiation on Global Ecosystems'. The report is a product of a workshop held in Sardinia, Italy from 28 September to 3 October 1992 on the consequences to global ecosystems of increased ultraviolet radiation due to stratospheric depletion.

The need to assess the impact of increased UV radiation on biological ecosystems has passed the theoretical stage.

The report is divided into two parts. Part one delineates the current state of knowledge of the effects of UV radiation on global ecosystems. Part two provides a detailed *research implementation plan* of the specific experimental objectives and tasks needed to begin assessment of UV impact on such ecosystems. The aim of the working group was to synthesize existing knowledge on the effects of UV radiation on biological ecosystems and to provide a plan of research to assess this question.

With their first report, 'Effects of Increased Ultraviolet Radiation on Biological Systems' [SCOPE, 1992, see *Chem. Intl.*, **15**, 24–25 (1993)], SCOPE stated that 'Some recent assessments of the stratosphere indicate high concentrations of chlorine over Northern and mid latitudes in the Northern Hemisphere comparable to, if indeed not higher than, chlorine levels in the stratosphere over the Antarctic. It appears, therefore, that the possibility of significant ozone depletion over heavily populated areas, in the foreseeable future, is real.'

Profs J. W. B. Stewart (SCOPE President) and Edward C. De Fabo (Chairman, Scientific Advisory Committee) write, in their covering letter to this report, that 'unfortunately, this prediction has come true earlier than expected. Decreased levels of stratospheric ozone have been reported over heavily populated areas of the Northern Hemisphere this past year and depletions of as much as 10–20% are reported to have occurred this summer (*Science*, 261: p. 290, 16 July 1993).'

Stewart and De Fabo point out that the need, therefore, for assessing the accompanying increase in UV radiation and its impact on biological systems, including humans, has now passed the theoretical stage. Indeed, the question now arises as to what impact ozone depletion may already have had on the welfare of the biosphere. This is illustrated elegantly, for example, in the satellite photographs provided by Dr Susan Ustin (University of California at Davis, USA) on the inside front and back covers of the report.

SCOPE has aimed this report at individuals of diverse backgrounds and professional interests and would specifically like to bring it to the attention of those charged with policy making authority so that a global commitment to this serious environmental problem will be made.

In their covering letter, Stewart and De Fabo conclude that there still remains an urgent need for a long-term commitment to research in UV-B radiation effects on biological systems. Even with the Montreal protocol and the welcome trend showing a slowing down in the rate of ozone depletion, models still project that it will be around the middle of the next century before the chlorine levels in the atmosphere will return to 1985 levels. Thus, UV-B radiation levels above that existing in 1985 are almost certainly going to occur well into the next century.

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Portuguese translation of report on reaction mechanisms

A Portuguese translation of 'System for symbolic representation of reaction mechanisms' (IUPAC Recommendations 1988) has been published in the magazine of the Brazilian Chemical Society *Química Nova* [17, **1**, 68–87 (1994)].

The recommendations were translated by Luiz Cláudio de A. Barbosa (Universidade Federal de Viçosa and Dorila Piló Veloso (Universidade Federal de Mina Gerais). The original English version was prepared for publication by Robert D. Guthrie (University of Kentucky, USA) of the Commission on Physical Organic Chemistry, Organic Chemistry Division and published in *Pure Appl. Chem.* **61**, 23–56 (1989).

Environmental Health Criteria

The *Environmental Health Criteria* (EHC) series of booklets is published by the International Programme on Chemical Safety (IPCS), a joint venture of the United Nations Environment Programme (UNEP), the International Labour Organization (ILO) and the World Health Organization (WHO). Each booklet reviews the human health and environmental implications of a chemical or group of chemicals.

There are now 148 titles in the series. Many of these have already been reviewed in *Chem. Intl.* [see for example, *Chem. Intl.* **16**, 58–64, (1994)]. They are available from WHO, Distribution and Sales, CH 1211 Geneva 27, Switzerland, and from sales agents for WHO in more than 50 countries. The latest titles in the series are:

Methyl Parathion

EHC 147 (1993) ISBN 92-4-157145-4, 244 pp. CHF 34./USD 30.60. Order No 1160 145.

This book evaluates the risks to human health and the environment posed by methyl parathion, a highly toxic organophosphorus ester insecticide. Close to 600 studies were critically assessed. Introduced as a commercial chemical in 1949, methyl parathion is used as a contact insecticide and acaricide for the protection of cotton, soybeans, cereals, tobacco, peanuts, vegetables, citrus fruits, and other crops. The compound is applied as a foliar spray by aircraft or ground equipment.

The opening section describes the compound's physical and chemical properties and outlines methods for its detections and analysis. A review of available data on the environmental behaviour of methyl parathion concentrates on the many physical, chemical, and biological factors that influence its distribution in air, water, soil, and environmental organisms. Data indicate that methyl parathion is rapidly degraded by numerous microorganisms and other forms of wild life, does not persist in the environment, is not bioconcentrated and is not transferred through food chains. Because methyl parathion shows virtually no movement through soil, the report concludes that neither the parent compound nor its breakdown products will contaminate groundwater when applied at recommended rates and intervals.

Concerning environmental levels and human exposure, the report cites residues in air, water, and food, resulting from agricultural or forestry practices, as the main sources of exposure for the general population. For workers, the principal sources of exposure are identified as occurring during production, formulation, handling, and application, with skin contact and, to a lesser degree, inhalation noted to be the main routes of exposure.

Because methyl parathion is a non-selective pesticide that kills beneficial species as well as pests, a section devoted to effects on environmental organisms concentrates on several studies documenting high toxicity for honey bees. These studies also show that incidents of bee kills were more severe with this insecticide than with others, underscoring the need to time spraying operations with extreme care. Data from laboratory studies of acute effects on aquatic animals are summarized in a 36-page table. While these effects are judged unlikely to occur under field conditions, the report concludes that methyl parathion should never be sprayed under windy conditions, and that overspraying of ponds, rivers, and lakes must be avoided.

The most extensive section evaluates studies of toxic effects observed in experimental animals and *in vitro* test systems. The report found no evidence of carcinogenicity associated with long-term exposure, and no evidence that this insecticide acts as a primary eye or skin irritant. The final section evaluates effects on humans, drawing on a number of case reports of accidental and sometimes fatal poisoning. The report concludes that the only confirmed effects on humans are the signs and symptoms characteristic of systemic poisoning by cholinesterase inhibiting organophosphorus compounds. No cases of organophosphorus-induced, delayed peripheral neuropathy have been reported. Concerning risks to workers, the report concludes that, with good work practices, hygienic measures, and safety precautions, methyl parathion is unlikely to present a hazard for occupationally exposed workers.

Methyl Ethyl Ketone

EHC 143 (1993) ISBN 92-4-157143-8, 161 pp. CHF 27.-/ USD 24.30; Order No 1160 143.

Methyl ethyl ketone (MEK) is widely used as an organic solvent, in protective coatings, magnetic tape production, food processing, varnishes and glues, shoe manufacture and printing plants.

General population exposure is low (away from MEK manufacturing areas, the major sources are probably vehicle exhausts and tobacco smoke). Industrial exposure to moderate levels of MEK is widespread. MEK on its own appears a relatively safe chemical, but its use with other solvents, in particular haloalkanes and unbranched aliphatic hexacarbons, should be avoided. Industries should be strongly encouraged to take all necessary precautions to ensure that workers are not exposed to either MEK or solvents whose toxicity is potentiated by MEK.

Principles for Evaluating Chemical Effects on the Aged Population

EHC 144 (1993) ISBN 92-4-157144-6, 159 pp. CHF 23.-/ USD 20.70; Order No 1160 144.

With increasing age, humans become more vulnerable to environmental chemicals due to the deterioration of physiological and psychological processes. But few, if any, of the hundreds of thousands of environmental chemicals have been tested for increased toxicity in the elderly.

TURPENTINE
SUBSTITUTE

Few, if any, of the hundreds of thousands of environmental chemicals have been tested for increased toxicity in the elderly. (*WHO photo by M. Jacot*)

This booklet reviews research findings and methodological concepts that can guide efforts to characterize the susceptibility of the aged population to the harmful effects of environmental chemicals. It discusses factors that complicate efforts to link chemical exposure to adverse health effects, and describes special methodological requirements that need to be met when investigating the effects of chemicals on the aged population.

1,3-Dichloropropene, 1,2-Dichloropropane and Mixtures

EHC 146 (1993) ISBN 92-4-157146-2, 261 pp. CHF 38. -/ USD 34.20; Order No 1160 146.

These compounds have been used in agriculture since 1956 as a pre-plant soil fumigant for the control of nematodes in vegetables, potatoes and tobacco. Risk to the general population is negligible because of low or non-existent exposure. Filling operations and field application may lead to operator exposure exceeding the maximum allowable concentration, when appropriate safety precautions have not been taken. Several cases of poisoning have been reported. 1,3-dichloropropene is unlikely to attain levels of environmental significance if used at the recommended rate.

Propachlor

EHC 147 (1993) ISBN 92 4 157147 0, 110 pp. CHF 20. /USD 18.00; Order No 1160 147.

Propachlor is a pre-emergence and early post-emergence herbicide, used to control annual grasses and some broad-leaved weeds in crops such as corn, sorghum, pumpkins, flax and flowers. It degrades quickly in the environment and does not bioconcentrate. It has been reported to cause dermatitis in workers, and precautions are recommended to protect the skin, eyes and respiratory tract. Exposure of the general population is unlikely under conditions of normal use. Though propachlor presents little hazard to birds, earthworms and honey-bees, it is toxic to some aquatic organisms. Water-courses therefore need special protection from contamination.

Benoyml

EHC 148 (1993) ISBN 92-4-157148-9, 135 pp. CHF 22. /USD 19.80; Order No 1160 148.

Benomyl is a systemic fungicide registered for use in over 70 crops in 50 countries. It is virtually insoluble in water, but decomposes in water or soil in a matter of hours to carbendazim.

No environmental monitoring data for benomyl appear to be available. What is known is that carbendazim remains in the soil surface layer and in leaf litter for up to 3 years. Earthworms have been shown to be adversely affected at recommended application rates, but there is no information on other soil or litter arthopods that would be similarly exposed. The main source of benomyl exposure for the general human population is residues in food crops.

Studies in the USA and the Netherlands have suggested average intakes of about one tenth of the recommended Acceptable Daily Intake for benomyl and carbendazim. Dermatitis and skin sensitization are the only effects reported for agricultural workers. The probability of benomyl having systemic toxic effects on humans through this route is very low.

Polychlorinated Biphenyls and Terphenyls (2nd Edition)

EHC 140 (1993) ISBN 92-4-157140-3, 682 pp. CHF 84.- / USD 75.60; Order No 1160 140.

The first edition of this booklet was published in 1976. Since then, a wealth of new information has become available, and IPCS decided to update it. Polychlorinated biphenyls (PCBs) and terphenyls (PCTs) are widely distributed in the environment, are persistent, accumulate in food webs, and are toxic to humans. Some countries have restricted manufacturing and use of PCBs since the 1970s, but production continues in some countries and large quantities continue to enter the environment from use or from waste.

Current sources of PCB release include volatilization from landfills containing PCB wastes or sewage sludge, incineration of municipal waste, and explosions of PCB containing transformers or capacitors. Reducing human PCB exposure to zero would be impossible (important food sources such as fish and breast milk would have to be banned). There are predictions that environmental PCB residues will be redistributed to the marine environment in the future. Monitoring is needed worldwide to track the expected increase in risk to marine mammals. Sensitive and specific biomarkers for PCBs' reproductive, immunological and neural toxicity should be developed for use in future epidemiological studies. Such studies are especially needed for new born infants. PCB disposal should be carried out by incineration at constant temperatures above 1000 °C.

Electromagnetic Fields (300 Hz to 300 GHz)

EHC 137 (1993) ISBN 92-4-157137-3, 290 pp. CHF 41.- / USD 36.90; Order No 1160 137.

Electromagnetic fields within these frequencies are generated by many human activities, including radio broadcasting, radar installations, induction heating stoves, microwave ovens, televisions and burglar alarms.

Sufficiently strong fields have a direct heating effect on the human body (in the same way as microwave ovens). It has been suggested that long-term exposure below thermally significant levels could also have effects – such as mutagenicity – but studies carried out to date do not support this.

The booklet sets exposure limits for electromagnetic fields in this frequency range, for the general population, and for those exposed occupationally, and recommends protective measures.

Chemical nomenclatures and the computer

Chemical Nomenclatures and the Computer, by D. J. Polton (University of Hull, UK), is the fourth in a series of books on *Computers and Chemical Structure Information*. The author proposes a new nodal number method for the chemical graph.

The methods and proposals are, it is claimed, equally applicable to organic and inorganic structures although the examples used throughout the book are organic chemical structures.

The eight chapter headings are: 1. Introduction, 2. Storage of the structure, 3. Derivation of the Path Connectivity Matrix, 4. Derivation of names for acyclic hydrocarbons, 5. Derivation of names for cyclic structures, 6. Problems with computer application, 7. Towards a new nomenclature, 8. Conclusion.

Chemical Nomenclatures and the Computer *by D. J. Polton and published by Research Studies Press Ltd., (Taunton, UK) and distributed by John Wiley & Sons Inc., (Chichester, UK), 1993. xii + 264 pp. ISBN 0 86380 156 0 and 0 471 94239 1. Price: USD 85.95/GBP 52.00.*

World Science Report 1993

The first part of UNESCO's *World Science Report* provides a global status report on science in the world today. Chapters within it are either devoted to complete regions or to countries or groups of countries whose science for one reason or another is at a particularly interesting stage of development. Authors were invited to give a personal appreciation of science in their parts of the world. Some chose to write accounts containing much data on research funding and manpower levels, reflecting the fact that some regions have a wealth of statistical material available on scientific research, training and development; other authors preferred to give more conceptual appraisals.

Part 2 of the report deals with science and technology systems, describing the manner and means by which science is organized and carried out, and showing how indicators of scientific activity can be interpreted to give a global picture of science in the world.

International cooperation, whether it be at intergovernmental or non-governmental level, is a major feature of science and technology today, stresses Mayor. Many scientific fields require extensive – and often expensive – research, and this can sometimes only be achieved by collective action on the part of governments, institutions or individuals. In Part 3, three exponents of such cooperation describe and discuss the many benefits and successes that have accrued from international partnerships.

In an attempt to transmit some of the excitement of modern discovery, UNESCO invited four scientists whose work keeps them in touch with developments across their disciplines to each write a readable, non-specialist account of just some of the significant developments in their fields during the course of the last two or three years. These chapters should be of interest to those not necessarily specialized in the respective areas, but wishing for such an overview. The number of subjects that could have been treated in this way was, of course, almost limitless. UNESCO was therefore obliged to be selective and for this first issue it has restricted coverage to the four basic sciences: mathematics, physics, chemistry and biology.

The chapter focusing on developments in chemistry over recent years covers the following topics: chemistry on the atomic scale including the development and applications of devices such as the scanning tunnelling microscope; femtosecond chemistry; new superconducting materials; fullerenes; CFCs and their alternatives; organic synthesis including asymmetric synthesis; and supramolecular chemistry.

The text of the report is complemented by an Appendix containing statistical data on national scientific manpower and expenditure taken from the most recent issue of UNESCO's *Statistical Yearbook*.

World Science Report 1993 *is published by UNESCO, Paris, France, 1993. 278 pp. ISBN 92-3-102938-X. Price: FRF 330/ GBP 29.00/USD 50.00.*

ISO 11469 is concerned with the identification and marking of plastic products.

Plastics in the environment

The February 1994 of *iso bulletin* opens with a four page article on 'Plastics and the environment: from office to garbage can and back again'. ISO is the International Organization for Standardization. The author of the article is Carleton Sperati who is convener of ISO/TC 61/SC 1/WG 1 on *General vocabulary*. It is this working group that produced ISO 11469 on 'Plastics – Generic identification and marking of plastic products' on which the article is based.

The article points to two particular concerns that have been identified since ISO 11469 was published:

- there is a need to provide rules for marking products containing\ flame-retardant materials
- rules are required for marking metallic parts fitted into a plastic part. An example is a petrol tank that has an insert of brass.

The second article in this issue of *iso bulletin* is on a related theme. It is entitled: 'ISO tackles the environment' and reports on the launch of TC 207 'Environment management'. Other reports include one on ISO 1514 'Paints and varnishes – Standard panels for testing'; ISO/TC 198 'Sterilization of health care products' and ISO 9391 on 'Water quality – Sampling in deep waters for macroinvertebrates – Guidance on the use of colonization, qualitative and quantitative samplers'.

Optics and dynamics of polymers

The invited lectures presented at the IUPAC sponsored 33rd Microsymposium on Macromolecules: Optics and Dynamics of Polymers were published in the March 1994 issue of *Die Makromolekulare Chemie: Macromolecular Symposium* (Vol. 79, 1–191). The meeting, which was the 6th meeting of the European Macromolecular Club, was held in Prague, Czech

Republic, 15 16 July 1993, and organized by the Institute of Macromolecular Chemistry, Prague, in conjunction with the Czech Chemical Society and the Academy of Sciences of the Czech Republic.

In the Preface to this volume, Jaroslav Kahovec (Symposium Editor), Petr Stepanek and Cestmir Konak (Symposium Chairmen) and Wyn Brown (European Macromolecular Club) report that 'the lectures covered various topics in progressive fields of polymer physics with emphasis put on the dynamic behaviour of polymers and its manifestation in optical properties.' Non-optical techniques of studying polymer dynamics were also discussed.

The opening lecture was presented by Nobel Prize winner Pierre-Gilles de Gennes (Professor at Collège de France, Paris) on the interfacial rheology of polymers. The paper, which was coauthored with F. Brochard Wyart (P.S.I., Instistut Curie, Paris), pointed out that very long chains with molecular weights up to 600 000 can be grafted onto a solid surface. De Gennes discussed some specific features of these grafted systems.

Other main areas included scattering from nonhomogeneous and dense media, dynamic properties of concentrated systems and glass-forming materials, phase separation phenomena, and scattering from polyelectrolyte systems and from solutions of rigid rods.

A panel discussion by Professor T. P. Lodge was divided into four topics: polyelectrolytes, blends and block copolymers, dynamics on surfaces and in confined spaces, and instrumentation and data analysis. The discussion was, according to the Preface, 'particularly heated after a thesis and antithesis were proposed; the thesis was: no further progress is possible in dynamic light scattering, and the antithesis was: this is just the beginning. As expected, the proponents of the antithesis were more vocal'.

Public support for scientific research also became a source of discussion. Professor de Gennes asked the question, 'What do the taxpayers want for their money?'. This was promptly echoed by Dr. Wiltzius with the related question, 'What do the stockholders want to do with their money?'

The scientific programme ended with a lecture by Professor W. Burchard reviewing the unsolved problems in dynamic light scattering.

ISO Memento 1994

The *ISO Memento*, published annually, provides information in English and French on the scope of responsibility, organizational structure, and secretariats for each technical committee. In addition, the Memento contains general information on the organization and administration of the work of ISO.

The end results of the ISO technical activity – the International Standards – are listed in the *ISO Catalogue*, published annually.

Requests for information concerning the work of ISO should be addressed to an ISO member or to the ISO Central Secretariat: 1, rue de Varembé, Case postale 56, CH-1211 Genève 20, Switzerland. Tel: +41 (22) 749 01 11. Fax: +41 (22) 733 34 30. Telex: 41 22 05 iso ch. Telegrams: isorganiz. E-mail: INTERNET: CENTRAL@ISOCS.ISO.CH X.400: C=CH; ADMD=ARCOM; PRMD=ISO; O=ISOCS; S=CENTRAL

ISO Standards

The following are some of the new international standards announced by the International Organization for Standardization (ISO) in recent issues of *ISO Bulletin*:

January 1994 issue of *ISO Bulletin*

TC 17	**Steel**
ISO 5000: 1993	Continuous hot-dip aluminium/ silicon-coated cold-reduced carbon steel sheet of commercial and drawing qualities
ISO 5001: 1993	Cold-reduced carbon steel sheet for vitreous enamelling
ISO 10543:1993	Seamless and hot-stretch-reduced welded steel tubes for pressure purposes – Full peripheral ultrasonic thickness testing
ISO 11496: 1993	Seamless and welded steel tubes for pressure purposes – Ultrasonic testing of tube ends for the detection of laminar imperfections
TC27	**Solid mineral fuels**
ISO 1213–1:1993	Solid mineral fuels – Vocabulary – Part 1: terms relating to coal preparation
TC 28	**Petroleum products and lubricants**
ISO 3014: 1993	Petroleum products – Determination of the smoke point of kerosene
ISO/TR 10481: 1993	Lubricants, industrial oils and related products – Class L – Specifications of categories L-AN,L-FC, L-FD and L- used for machine tools
TC 33	**Refractories**
ISO 10060:1993	Dense, shaped and refractory products – Test methods for products containing carbon
TC 35	**Paints and varnishes**
ISO 1514: 1993	Paints and varnishes – Standard panels for testing
ISO 11124–1: 1993	Preparation of steel substrates before application of paints and related products – Specifications for metallic blast-cleaning abrasives – Part 1: General introduction and classification
ISO 11124–2: 1993	Preparation of steel substrates before application of paints and related products – Specifications for metallic blast- cleaning abrasives – Part 2: Chilled iron grit
ISO 11124–3: 1993	Preparation of steel substrates before application of paints and related products – Specifications for metallic blast-cleaning abrasives – Part 3: High carbon cast-steel shot and grit
ISO 11124–4: 1993	Preparation of steel substrates before application of paints and related products – Specifications for metallic blast-cleaning abrasives – Part 4: Low carbon cast-steel shot
ISO 11125–1:1993	Preparation of steel substrates before application of paints and related products – Test methods for metallic blast-cleaning abrasives – Part 1: Sampling
ISO 11125–2: 1993	Preparation of steel substrates before application of paints and related products – test methods for metallic blast-cleaning abrasives – Part 2: Determination of particle size distribution
ISO 11125–3: 1993	Preparation of steel substrates before application of paints and related products – Test methods for metallic blast-cleaning abrasives – Part 3: Determination of hardness
ISO 11125–4: 1993	Preparation of steel substrates before application of paints and related products – test methods for metallic blast -cleaning abrasives – Part 4: Determination of apparent density
ISO 11125–5: 1993	Preparation of steel substrates before application of paints and related products –

	test methods for metallic blast-cleaning abrasives – Part 5: Determination of percentage defective particle and of microstructure
ISO 11125–6: 1993	Preparation of steel substrates before application of paints and related products – Test methods for metallic blast-cleaning abrasives – Part 6: Determination of foreign matter
ISO 11125–7: 1993	Preparation of steel substrates before application of paints and related products – test methods for metallic blast-cleaning abrasives – Part 7: Determination of moisture
ISO 11126–1: 1993	Preparation of steel substrates before application of paints and related products – Specifications for non-metallic blast-cleaning abrasives – Part 1: General introduction and classification
ISO 11126–3: 1993	Preparation of steel substrates before application of paints and related products – Specifications for non-metallic blast-cleaning abrasives – Part 3: Copper refinery slag
ISO 11126–4: 1993	Preparation of steel substrates before application of paints and related products – Specifications for non-metallic blast-cleaning abrasives – Part 4: Coal furnace slag
ISO 11126–5: 1993	Preparation of steel substrates before application of paints and related products – Specifications for non-metallic blast-cleaning abrasives – Part 5: Nickel refinery slag
ISO 11126–6: 1993	Preparation of steel substrates before application of paints and related products – Specifications for non-metallic-blast-cleaning abrasives – Part 6: Iron furnace slag
ISO 11126–8: 1993	Preparation of steel substrates before application of paints and related products – Specifications for non-metallic-blast-cleaning abrasives – Part 8: Olivine sand
ISO 11127–1: 1993	Preparation of steel substrates before application of paints and related products – test methods for non-metallic blast-cleaning abrasives – Part 1: Sampling
ISO 11127–2: 1993	Preparation of steel substrates before application of paints and related products – test methods for non-metallic blast-cleaning abrasives – Part 2: Determination of particle size distribution
ISO 11127–3: 1993	Preparation of steel substrates before application of paints and related products – test methods for non-metallic blast-cleaning abrasives – Part 3: Determination of apparent density
ISO 11127–4: 1993	Preparation of steel substrates before application of paints and related products – test methods for non-metallic blast-cleaning abrasives – Part 4: Assessment of hardness by a glass slide test
ISO 11127–5: 1993	Preparation of steel substrates before application of paints and related products – test methods for non-metallic blast-cleaning abrasives – Part 5: Determination of moisture
ISO 11127–6: 1993	Preparation of steel substrates before application of paints and related products – test methods for non-metallic blast-cleaning abrasives – Part 6: Determination of water-soluble contaminants by conductivity measurement
ISO 11127–7: 1993	Preparation of steel substrates before application of paints and related products – test methods for non-metallic blast-cleaning abrasives – Part 7: Determination of water - soluble chlorides
TC 61	**Plastics**
ISO 472: 1988/ Amd 1: 1993	Amendment 1 to ISO 472: 1988 terms relating to individual macromolecules, their assemblies, dilute polymer solutions and crystalline polymers
ISO 472: 1988/ Amd 3: 1993	Amendment 3 to ISO 472: 1988 general terms and terms relating to degradable plastics
ISO 472: 1988/ Amd 4: 1993	Amendment 4 to ISO 472: 1988 Basic terms in polymer science
ISO 3597–1: 1993	Textile-glass-reinforced plastics – Determination of mechanical properties on rods made of roving-reinforced resin – Part 1: general considerations and preparation of rods
ISO 3597–2: 1993	Textile-glass-reinforced plastics – Determination of mechanical properties on rods made of roving-reinforced resin – Part 2: Determination of flexural strength
ISO 3597–3: 1993	Textile-glass-reinforced plastics – Determination of mechanical properties on rods made of roving-reinforced resin – Part 3: Determination of compressive strength
ISO 3597–4: 1993	Textile-glass-reinforced plastics – Determination of mechanical properties on rods made of roving-reinforced resin – Part 4: Determination of apparent interlaminar shear strength
ISO 4593: 1993	Plastics – Film and sheeting – Determination of thickness by mechanical scanning
ISO 4603: 1993	Textile glass – Woven fabrics – Determination of thickness
ISO 4899: 1993	Textile-glass-reinforced thermosetting plastics – Properties and test methods
ISO 10371: 1993	Reinforcement materials – Braided tapes – Basis for a specification
ISO 11248: 1993	Plastics – Thermosetting moulding materials – evaluation of short-term performance at elevated temperatures
ISO 11401: 1993	Plastics – Phenolic resins – Separation by liquid chromatography
ISO 11402: 1993	Plastics – Condensation resins – Determination of free formaldehyde
ISO 11409: 1993	Plastics – Phenolic resins – Determination of heats and temperatures of reaction by differential scanning calorimetry
TC 106	**Dentistry**
ISO 1562: 1993	Dental casting gold alloys
ISO 8891: 1993	Dental casting alloys with noble metal content of 25% up to but not including 75%

TC 155	**Air quality**
ISO 4226: 1993	Air quality – General aspects – Units of measurement
TC 155	**Nickel and nickel alloys**
ISO 11438–1: 1993	Ferronickel-Determination of trace-element content by electrothermal atomic absorption spectrometric method – Part 1: General requirements and sample dissolution
ISO 11438–2: 1993	Ferronickel-Determination of trace-element content by electrothermal atomic absorption spectrometric method – Part 2: Determination of lead content
ISO 11438–3: 1993	Ferronickel-Determination of trace-element content by electrothermal atomic absorption spectrometric method – Part 3: Determination of antimony content
ISO 11438–4: 1993	Ferronickel-Determination of trace-element content by electrothermal atomic absorption spectrometric method – Part 4: Determination of tin content
ISO 11438–5: 1993	Ferronickel-Determination of trace-element content by electrothermal atomic absorption spectrometric method – Part 5: Determination of tellurium content
ISO 11438–6: 1993	Ferronickel-Determination of trace-element content by electrothermal atomic absorption spectrometric method – Part 6: Determination of thallium content
ISO 11438–7: 1993	Ferronickel-Determination of trace-element content by electrothermal atomic absorption spectrometric method – Part 7: Determination of silver content
ISO 11438–8: 1993	Ferronickel-Determination of trace-element content by electrothermal atomic absorption spectrometric method – Part 8: Determination of indium content
TC 180	**Solar energy**
ISO 9846: 1993	Solar energy – Calibration of a pyranometer using a pyrheliometer
TC 190	**Soil quality**
ISO 10381–6: 1993	Soil quality – Sampling – Part 6: Guidance on the collection, handling and storage of soil for the assessment of aerobic microbial processes in the laboratory
ISO 11269–1: 1993	Soil quality – Determination of the effects of pollutants on soil flora – Part 1: Method for the measurement of inhibition of root growth
ISO 11465: 1993	Soil quality – Determination of dry matter and water content on a mass basis – Gravimetric method
TC 194	**Biological evaluation of medical devices**
ISO 10993–11: 1993	Biological evaluation of medical devices – Part 11: Tests for systemic toxicity

February 1994 issue of *ISO Bulletin*

TC 28	**Petroleum products and lubricants**
ISO 3837: 1993	Liquid petroleum products – Determination of hydrocarbon types – Fluorescent indicator adsorption method
TC 34	**Agricultural food products**
ISO 3632–1: 1993	Saffron (*Crocus sativus* Linnaeus) – Part 1: Specification
ISO 3632–2: 1993	Saffron (*Crocus sativus* Linnaeus) – Part 2: Test methods
ISO 7251: 1993	Microbiology – General guidance for enumeration of presumptive *Escherichia coli* – Most probable number technique
TC 45	**Rubber and rubber products**
ISO 8031: 1993	Rubber and plastics hoses and hose assemblies – Determination of electrical resistance
TC 61	**Plastics**
ISO 899–1: 1993	Plastics – Determination of creep behaviour – Part 1: Tensile creep
ISO 899–2: 1993	Plastics – Determination of creep behaviour – Part 2: Flexural creep by three – point loading
ISO 1872–1: 1993	Plastics – Polyethylene (PE) moulding and extension materials – Part 1: Designation system and basis for specifications
ISO 8986–1: 1993	Plastics – Polybutene (PB) moulding and extrusion materials – Part 1: Designation system and basis for specifications
ISO 10350: 1993	Plastics – Acquisition and presentation of comparable single-point data
TC 67	**Materials, equipment and offshore structures for petroleum and natural gas industries**
ISO 10400: 1993	Petroleum and natural gas industries – Formulae and calculation for casing, tubing, drill pipe and line pipe properties
ISO 10407: 1993	Petroleum and natural gas industries – Drilling and production equipment – drill stem design and operating limits
ISO 10409: 1993	Petroleum and natural gas industries – Application of cement lining to steel tubular goods, handling, installation and joining
ISO 10417: 1993	Petroleum and natural gas industries – Subsurface safety valve systems – Design, installation operation and repair
ISO 10418: 1993	Petroleum and natural gas industries – Offshore products platforms – Analysis, design, installation and testing of basic surface safety systems
ISO 10427: 1993	Petroleum and natural gas industries – Gow-spring casing centralizers – Specification
ISO 10428: 1993	Petroleum and natural gas industries – Sucker rods (pony rods, polished rods, couplings and sub-couplings) – Specification
ISO 10431: 1993	Petroleum and natural gas industries – Pumping units – Specification
ISO 10432: 1993	Petroleum and natural gas industries – Subsurface safety valve equipment – Specification
ISO 10436: 1993	Petroleum and natural gas industries – General-purpose steam turbines for refinery service
ISO 10437: 1993	Petroleum and natural gas industries – Special-purpose steam turbines for refinery service
TC 85	**Nuclear energy**
ISO 11482: 1993	Guidelines for plutonium dioxide ($Pu0_2$) sampling in a nuclear reprocessing plant
TC 122	**Packaging**
ISO 7965–2: 1993	Sacks – drop test – Part 2: Sacks made from thermoplastic flexible film
ISO 8367–2: 1993	Packaging – Dimensional tolerances for general purpose sacks – Part 1: Paper sacks
ISO 8367–2: 1993	Packaging – Dimensional tolerances for general purpose sacks – Part 2: Sacks made form thermoplastic flexible film
TC 138	**Plastics pipes, fittings and valves for the transport of fluids**
ISO/TR 8584–2:1993	Thermoplastics pipes for industrial applications under pressure- Determination of the chemical resistance factor and of the basic stress – Part 2: Pipes made of halogenated polymers
ISO/TR 10501: 1993	Thermoplastics pipes for the transport of liquids under pressure – Calculation of head losses
TC 154	**Documents and data elements in administration, commerce and industry**
ISO 7372: 1993	Trade data interchange – Trade data elements directory (Endorsement of UNECE/TDED, volume 1)
TC 190	**Soil quality**
ISO 11268–1: 1993	Soil quality – effects of pollutants on earthworks (*Eisenia fetida*) – Part 1: Determination of acute toxicity using artificial soil substrate

March 1994 issue of *ISO Bulletin*

TC 17	**Steel**
ISO 9302: 1994	Seamless and welded (except submerged arc-welded) steel tubes for pressure purposes – Electromagnetic testing for verification of hydraulic leak-tightness
ISO 10332: 1994	Seamless and welded (except submerged arc-welded) steel tubes for pressure purposes – Ultrasonic testing for the verification of hydraulic leak-tightness
ISO 10697–2: 1993	Steel – Determination of calcium content by flame atomic absorption spectrometry – Part 2: Determination of total calcium content
TC 35	**Paints and varnishes**
ISO 9020: 1994	Binders for paints and varnishes – Determination of free-formaldehyde content of amino resins – Sodium sulfite titrimetric method
TC 45	**Rubber and rubber products**
ISO 34–1: 1994	Rubber, vulcanized or thermoplastic – Determination of tear strength – Part 1: trouser, angle and crescent test pieces
ISO 1431–2: 1994	Rubber, vulcanized or thermoplastic – Resistance to ozone cracking – Part 2: Dynamic strain test
ISO 6471: 1994	Rubber, vulcanized – Determination of crystallization effects under compression
TC 92	**Fire tests on building materials, components and structures**
ISO/TR 9122–3: 1993**	Toxicity testing of fire effluents – Part 3: Methods for the analysis of gases and vapours in fire effluents
ISO/TR 9122–6:1994	Toxicity testing of fire effluents – Part 6: Guidance for regulators and specifiers on the assessment of toxic hazards *n* fires in buildings and transport
TC 102	**Iron ores**
ISO 4698: 1994	Iron ore pellets – Determination of relative free-swelling index
ISO 1038: 1994	Iron ores – Method of sampling and sample preparation for physical testing
TC 126	**Tobacco and tobacco products**
ISO 10326–2: 1994	Cigarettes – Determination of water in smoke condensates – Part 2: Karl Fischer method
TC 146	**Air quality**
ISO 8756: 1994	Air quality – Handling of temperature, pressure and humidity data
TC 147	**Water quality**
ISO 5961–7: 1994	Water quality – Determination of cadmium by atomic absorption spectrometry
TC 150	**Implants for surgery**
ISO 5832–7: 1994	Implants for surgery – Metallic materials – Part 8: Forgeable and cold-formed cobalt–chromium–nickel–molybdenum–iron alloy
ISO 6474: 1994	Implants for surgery – Ceramic materials based on high purity alumina
TC 193	**Natural gas**
ISO 6326–4: 1994	Natural gas – Determination of sulfur compounds – Part 4: Gas chromatographic method using a flame photometric detector for the determination of hydrogen sulfide, carbonyl sulfide and sulfur-containing odorants
TC 198	**Sterilization of health care products**
ISO 11134: 1994	Sterilization of health care products – requirements for validation and routine control – Industrial moist heat sterilization
ISO 11135: 1994	Medical devices – Validation and routine control of ethylene oxide sterilization

** French version of standard previously published in English only

KWIC Index of international standards

The *KWIC Index of international standards* is published jointly by the International Organization for Standardization (ISO) and the International Electrotechnical Commission (IEC). The index is designed to provide a single comprehensive source for the identification of all international standards on a given subject. Some 15 700 titles, published by ISO, IEC and 26 other international standardizing bodies, are listed in the sixth edition, using the 'Keyword-in-context' (KWIC) format. Full instructions on how to obtain the documents are given.

KWIC is aimed at national standards bodies, governmental authorities, regulatory bodies, technical libraries and all those concerned with the application of international standards.

KWIC Index of international standards, *6th Edn, 1993, format A4, 766 pp. Price CHF 127.-. Available from ISO and IEC national members or from the ISO Central Secretariat and IEC Central Office. [ISO Central Secretariat, 1, rue de Varembé, CH-1211 Geneva 20, Switzerland, Tel: +41 (22) 749 01 11. Fax: +41 (22) 733 34 30. Telex: 41 22 05 iso ch.]*

Analysis of milk and milk products

The *Inventory of IDF/ISO/AOAC adopted methods of analysis and sampling for milk and milk products* (4th Edition) is published by the IDP (International Dairy Federation), ISO (International Organization for Standardization) and AOAC (Association of Official Analytical Chemists) International Secretariats. This inventory of dairy analytical methods includes two lists – one classified on the basis of the products to which the methods apply, and the other classified on the property or component being sampled, examined or analysed, both in alphabetical.

The 36-page inventory is available in English only. Ref: Bulletin No. 286/1993 – BEF 1500. The publication is available from the IDF Secretariat (see below).

The volume *Analytical Quality Assurance and Good Laboratory Practice in Dairy Laboratories* contains the proceedings of a seminar held in Sonthofen, Germany, in May 1992. The book examines the role of quality assurance in the comparability and reliability of dairy laboratory measurements in sec-

IDF have recently published an inventory on the analysis of milk and milk products.

tions on basic needs and concepts (3 chapters), general requirements (4 chapters), intralaboratory (8 chapters) and interlaboratory aspects (7 chapters) for dairy institutes, aspects for central testing laboratories (7 chapters) and aspects for dairy factory laboratories (8 chapters). There are also 14 briefer contributions, making 53 chapters in all.

The 429 page volume Analytical QA & GLP in Dairy Laboratories *is available in English only and is Special Issue No. 9302 of the International Dairy Federation. ISBN 92 9098 010 2. Price BEF 3900.*

To order IDF publications and for further information please contact: International Dairy Federation (IDF) General Secretariat, Square Vergote 41, B-1040 Brussels, Belgium. Tel: + 32 (2) 733 98 88. Fax: +32 (2) 733 04 13. Telex: 046 63818.

Metrology

Two new publications from the International Organization for Standardization (ISO) for your attention are the *International Vocabulary of Basic and General Terms in Metrology* (the "VIM") and the *Guide to the Expression of Uncertainty in Measurement* (the "Guide").

The science of metrology (literally, the science of measurement) is a subject of importance to all of us who attempt to make precise quantitative measurements. ISO has a Technical Advisory Group on Metrology (ISO/TAG4), ON WHICH IUPAC has ex-officio representation, whose function is to make internationally agreed recommendations in this field. ISO/TAG4 produced two important publications in 1993 with the above titles which will be of interest to all of us who are concerned with experimental measurements.

The VIM is a vocabulary of terms in metrology. For those who wish to be careful in their use of words it is a reference text to have on the shelf above your desk. It is 60 pages long, with French and English text side by side in a two column format. It provides concise definitions of 120 key terms in metrology. With associated examples and notes, each entry averages 40–50 words in total.

The Guide is a somewhat longer manual, approximately 100 pages, which sets out how the uncertainty in quantitative measurements should be evaluated. The text is in English, and is divided into 8 chapters covering a total of 28 pages. the Chapter headings are: 'Scope', Definitions', 'Basic Concepts', 'Evaluation Standard Uncertainty', 'Determining Combined Standard Uncertainty', 'Determining Expanded Uncertainty', 'Reporting Uncertainty', and 'Summary'. As with the VIM, this is a valuable book form which one may revise and clarify ones knowledge of the subject, and then keep as a reference text.

As an example, I wonder how many of us clearly distinguish between the very different terms **error** (**of measurement**)and **uncertainty of measurement**? In my experience 80% of my colleagues use the word error when they mean uncertainty, in phrases such as ' the concentration was determined to be 0.1052 mol/dm^3, with an error of ± 0.0020 mol/dm^3. The correct definition of an error is 'observed value minus true value', and thus the error in a measurement is generally unknown (because we never know the true value). Indeed it may often be the case that the error in a particular measurement is (by chance) very small, perhaps much smaller than the uncertainty in the same measurement. These are the sort of concepts on which thinking will be clarified by referring to the VIM and the Guide. IUPAC is considering preparing a condensed version of the Guide for use by chemists.

International Vocabulary of Basic and General Terms in Metrology, *Second edition (English and French), 1993, pp. 59, ISBN 92-67-01075-1, and* Guide to the Expression of Uncertainty in Measurement, *First edition (English), 1993, pp. 101, ISBN 92-67-10188-9, are published by the International Organization for Standardization, ISO Central Secretariat, 1, rue de Varembé, CH-1211 Geneva 20, Switzerland.*

Ian Mills

News & Views

UV radiation can seriously damage your health

Warning that public awareness of the dangers of overexposure to ultraviolet (UV) radiation remains insufficient, the World Health Organisation (WHO) stresses once again that increased levels of UV radiation directly linked to ozone depletion may have serious consequences on public health. This warning was issued by experts following a meeting (8–11 December 1993) on the effects of UV radiation organized in Geneva by WHO's Division of Environmental Health. The meeting finalized the text of the most comprehensive study ever conducted on the subject. It is to be published by WHO in 1994.

Participants in the meeting also examined a number of fundamental issues within the framework of the International Programme on Health, Solar UV Radiation and Environmental Change (INTERSUN). The Programme, created this year by the International Agency for Research on Cancer, United Nations Environment Programme and WHO, is developing a network of centres monitoring trends in ground level solar UV radiation, sun exposure of populations, and the occurrence of health effects associated with UV sun exposure of populations, and the occurrence of health effects associated with UV radiation. Its findings will help to address environmental and public health problems associated with the increased UV levels stemming from depletion of the ozone layer.

In many countries, suntanning is still not only culturally acceptable but desirable.

Exposure to ultraviolet radiation occurs from both natural (the sun) and artificial (ultraviolet lamps) sources. Ultraviolet radiation is used in medicine and various industries. In terms of human health, ultraviolet radiation is a double-edged sword. While low doses are beneficial, assisting with our production of vitamin D, prolonged or intense exposure can cause serious damage to the immune system as well as trigger various skin and eye diseases, including cancer.

Recent scientific findings show the 1992 and 1993 global ozone levels to be the lowest since records of satellite observations started in 1978. A 10% reduction in the ozone could lead to as much as a 15–20 per cent increase in UV exposure. 'This is a classic example of our run-away industrialization backfiring on us', says Dr J. C. van der Leun, Chairman of the meeting. 'The sooner we get to grips with this problem the better, before it starts seriously hurting our lives and livelihood – be it health, crop production or the fishing industry'. Increased exposure to ultraviolet radiation stunts plant growth, adversely affects photosynthesis and diminished disease resistance. Ironically, the greatest increases in UV radiation are observed in rural areas of the world with clean air as compared to urban centres where severe air pollution forms a barrier which reduces UV penetration. But once atmospheric pollutants are cleared, the chemical shield above all major cities of the world will disappear, resulting in an increase in UV radiation.

Excessive ultraviolet radiation exposure is known to be associated with increase in skin cancers, diseases of the eye and a reduced ability of the body to combat infectious diseases.

A weakened immune system will contribute to the acceleration of the development of skin cancer. It develops sooner and faster. Epidemiological data suggests that in some countries – Australia, New Zealand, USA – skin cancer hits people in their early 50's, some 10 years younger than 30 years ago. Because children usually wear less clothing and spend more time outdoors than adults, by the age of 18, they will have received half of the total UV radiation exposure they are likely to receive throughout their lifetime. 'It is crucially important to protect children up to the age of 15 from excessive exposure to intense sunlight, especially from 10.00 a.m. to 2 p.m.' says Dr Jean-Pierre Cesarini of the National medical Research Institute of France (INSERM), 'No sunbathing, wear protective clothing, including wide-brimmed hats, sunscreens with a sun protection factor of at least 15, are the basic guidelines for the parents'.

Acute effects of UV on the skin consist of solar erythema or sunburn, which, if severe enough, may result in blistering and destruction of the surface of the skin, similar to a first or second degree burn. Chronic skin changes due to UV manifest themselves in premature 'ageing' or wrinkling of the skin and malignant skin tumours. The incidence of skin cancer is the highest among indigenous populations of the equatorial regions of the world.

Prolonged exposure of the eyes may lead to the development of cancer of conjunctiva and cataracts. Half of the world's 35 million blind people lost their eyesight because of cataract. it is believed that the disease may be triggered off by shorter wavelength UV in as many as 3.5. million people, or 20% of the global figure of cataract sufferers. In the so-called 'cataract belt', geographical areas near the equator, the condition strikes individuals in the prime of life, between 35 and 45 years of age. On the contrary, in Europe and North America it is a disease of the elderly. In the tropical regions, which lack the sharp seasonal variation of northern latitudes, UV radiation is much more intense.

In order to avoid acute effects of UV on the eyes, which are unpleasant but usually reversible, it is normally sufficient to wear sunglasses. However, the glasses should be able to screen off UV radiation, not merely excess light. The eye will absorb, otherwise, even greater amounts of UV compared to the naked eye.

With more leisure time and cheaper air travel, more and more people spend their holidays in the warm sunny climes of the world. In many countries, sun-tanning is still not only culturally acceptable but desirable. Over the years, Australia has emerged as a country with a very high incidence of skin cancer. Several years ago, the national public health authorities and the media launched a nation-wide campaign trying to change the general public's behaviour outdoors. There are three basic recommendations: while out in the sun, cover yourself with protective clothing, wear UV absorbing sunglasses and try to stay indoors at noontime, the period when UV radiation is most intense. 'The worst thing one can do is to go out jogging at lunchtime in summer', says Dr Cesarini 'There may be a hundred-fold difference in the amount of UV radiation between early morning hours and noontime. After all, the folksy wisdom of siesta, which literally means noon, is not to be spurned'.

For further information, please contact Dr Mike Repacholi, Consultant at the Division of Environmental Health, WHO. Tel: +41 (22) 791 3729. Fax: +41 (22) 791 0746.

75th IUPAC anniversary events in Russia

The National Committee of Russian Chemists of the Russian Academy of Sciences is organizing a programme of events in Russia to celebrate the 75th anniversary of IUPAC.

These events will include a special 'TV page' dedicated to the theme 'Chemistry for Life' within the framework of Russia's 'Open World' TV programme. Famous scientists in the field of chemistry, pharmacology, medicine and agriculture will participate in the programme. They will include Professor Kirill Zamaraev (IUPAC President and Chairman of the National Committee), Professor Oleg Nefedov (Vice-President of the Russian Academy of Sciences) and Dr B. Saltykov (Minister of Science and Development).

The anniversary programme will also include:

- A series of lectures by leading chemists on topics relating to 'Chemistry for Life'.
- An International School Chemistry Olympiad involving children from all the states of the former USSR (to be held in Pyschino).
- A meeting of chemistry teachers in Moscow on 27 August.
- A 'Chemist's Day' at Moscow State University.
- A meeting of chemistry students at Moscow's universities on 1 and 2 September.

A series of popular articles on the 'Chemistry for Life' theme will also appear in the Russian magazine *Chemistry for Life*. These articles will cover topics such as: chemistry and scientific knowledge (problems and methods of chemistry and related fields); chemistry and the environment; chemistry and health (drugs, new materials for medical treatment); and chemistry in everyday life. The magazine will also publish interviews with scientists and state officials concerning various aspects of chemistry. In addition, the magazine will carry news about specific IUPAC activities, problems of chemical disarmament and advertise the 'Chemistry for the 21st Century' series of IUPAC books.

Additional events will include special publications on the IUPAC Anniversary in the *Journal of the Mendeleev Chemical Society* and a meeting of journalists and editors at an IUPAC European Press Day.

Olef Nefedov (top right) and Kirill Zamaraev (right) are involved in IUPAC anniversary events in Russia. The programme includes a 'Chemist's Day' at Moscow State University.

Looking forward to the year 00 in Bangkok

A recent exchange of correspondence in the *Bangkok Post* caught the eye of a member of the editorial team of *iso bulletin*:

'I called at the Post Office to find out how we might have to write the abbreviated date for the year 2000,' wrote the enquirer. 'We thought that 6/24/00 might be right, but that does not tell the exact year,' and she goes on to ask what the correct form would be. The *Bangkok Post* tries to get to the bottom of the problem, but after some research comes back with a blank, and provides a 'best educated guess' of 'September 1, 2000'.

Well, there's a much simpler way to know, according to *iso bulletin* (January 1994, page 15): look simply at ISO 8601, *Data elements and interchange formats – Information interchange – Representation of dates and times*. It gives the answer right away: 2000-09-01. Or, suggests the author, flip through the ISO leaflet on the subject. Here's what it has to say:

A need: a worldwide system

'The accelerating growth of international communication, and all the different forms of information exchange which result, require that the numeric representation of dates and times in data interchange must be the same – throughout the world.

'The aim is to eliminate any errors of misinterpretation and the resulting costs, while at the same time facilitating classification and filing, whether manually or electronically.

'International Standard ISO 8601

Data elements and interchange formats – Information interchange – Representation of dates and times

'So as to achieve a simple, logical and coherent format, ISO has developed International Standard ISO 8601. It advises numeric representation of dates and times on an internationally agreed basis – from larger to smaller elements:

Year–Month–Day–Hour

'This system primarily avoids confusion, but also has the advantage of flexibility: you can express every element of time or only the ones you need. Furthermore, the system facilitates arithmetic calculation, particularly in computer uses.

Examples of representation

DATE

How do you represent 5 December 1999?

ISO Standard: 1999-12-05

DATE + HOUR + MINUTE + SECOND

How do your represent 5 December 1999, 23 hours, 20 minutes and 50 seconds?

ISO Standard: 1999-12-05 T 23:20:50

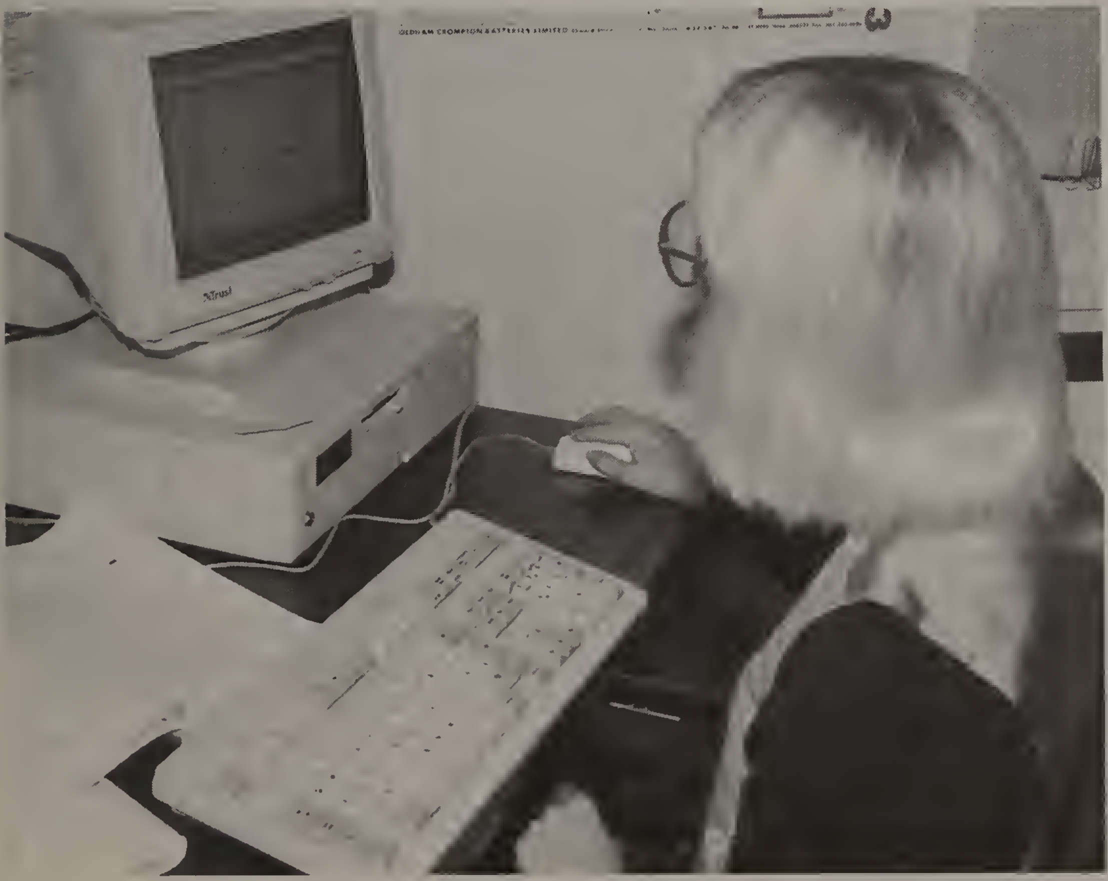
DATE (BY NUMBERING OF WEEKS AND DAYS)

'Exchanges in international business, company meeting calendars and accounting often find it practical to identify a date by week and day numbers. (Monday has been found the most appropriate first day of the week.)

How do you represent Friday 9 April 1999?

ISO Standard: 1999-W14-5.'

If you have to represent in numeric form: calendar dates, ordinal dates, dates identified by week number, periods of time, combined date and time of the day, etc., all the answers to these questions, and to many, many more, are to be found quite simply in the International Standard ISO 8601. You won't – you can't – go wrong with your date if you know where to look. [*iso bulletin*, January 1994, page 15]



The ISO Standard on representation of dates and times facilitates arithmetic calculation, particularly in computer uses.

Change of editor

IUPAC is in the process of recruiting a 'Senior Member of Staff' to work at its Secretariat in Oxford. The candidate, whose responsibilities will include editing *Chemistry International,* will succeed IUPAC Information Officer/Affiliate Affairs Secretary Mike Freemantle who left his post with IUPAC in June to become European Science Editor for *Chemical & Engineering News* – the weekly magazine of the American Chemical Society.

Interviews for the post, which was advertised in May, are planned for July, and it is hoped that the person appointed will start work at the Oxford Secretariat in October or November at the latest. Meanwhile, freelance industrial chemicals and life sciences writer Mike Ward has agreed to edit *CI* on a temporary basis. Ward has worked as a writer and editor for *Chemistry & Industry, European Chemical News, Chemical Week* and other magazines.

Solubility Data Series

Oxford University Press are the new publishers of the IUPAC Solubility Data Series. They will be publishing Volumes 54 onwards. For further details of prices and availability of back stock please contact:

Journals Subscription Department, Oxford University Press, Walton Street, Oxford OX2 6DP. Tel: +44 (865) 56767. Fax: +44 (865) 267773.

Names and Addresses

Full details (names, addresses, telephone/telex/fax numbers, and e-mail) of officers of IUPAC bodies were published in *Chem. Intl.* **15**, 215–227 (1993). The IUPAC Secretariat has since been notified of the following changes:

Prof. Willem H. KOPPENOL (Secretary, Commission on Nomenclature of Inorganic Chemistry). Fax: + 1 (504) 388 4936.

Dr. Michael LINSCHEID (Secretary, Commission on Microchemical Techniques and Trace Analysis). E-mail: linscheid@helios.isas-dortmund.de

Prof. Y.-F. LIU (Chairman, Commission on Radiochemistry and Nuclear Techniques). Tel: +86 (1) 2501871 (office); +86 (1) 2502972 (home). E-mail: <@servo2,slac,stanford. Edu:tangxy@bepc>

Dr. René-Paul MARTIN (Secretary, Committee on Chemistry and Industry). Cabinet du Ministre de l'Education Nationale, 110, Rue de Grenelle, Paris, France. Tel: +33 (1) 49 55 21 60. Fax: +33 (1) 49 55 39 06.

Dr. H. D. OLESEN (Chairman, Clinical Chemistry Division Committee on Quantities and Units). Tel: +45 (35) 45 76 42. Fax: +45 (35) 45 27 45.

Prof. Willem E. VAN DER LINDEN (Chairman, Committee on General Aspects of Analytical Chemistry). E-mail:. w.e.vanderlinden@ct.utwente.nl

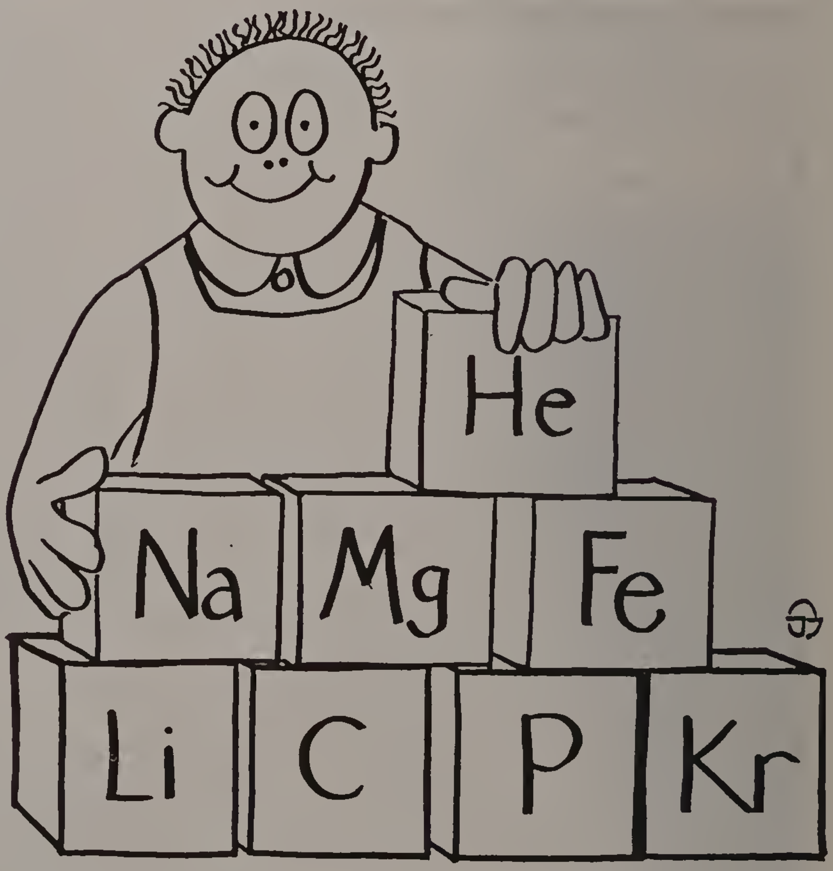
Author deadlines for *CI* 1995

The following are the deadlines for receipt of items at the IUPAC Secretariat in Oxford for publication in 1995 issues of *Chemistry International* (*CI*). Authors of feature articles and other lengthy items should submit their contributions well in advance of these dates. Since *CI* is a news magazine it is not possible to guarantee publication of any item in a particular issue. In many cases it is necessary to postpone publication of material to a later issue.

Please note that the International Organization for Standardization (ISO) agreed format for writing dates is used as follows: year-month-day.

CI *Vol. 17, 1995 issue*	*Deadline for receipt of material*
No.1 (January)	94.10.07
No. 2 (March)	94.12.02
No. 3 (May)	95.02.03
No. 4 (July)	95.04.07
No. 5 (September)	95.06.09
No. 6 (November)	95.08.04

Authors submitting contributions to *CI* are asked to refer to '*Chemistry International*: guidelines for authors' [*Chem. Intl.* **14**, 232, (1992)].



Cartoons and other contributions

Affiliates are invited to submit cartoons, news items and reports for publication in *Chemistry International*. The Editor will be happy to consider all such contributions.

Affiliate Affairs

Information for affiliates

IUPAC publications

Affiliates are entitled to a 25% reduction and in some cases a 40% reduction on the cost of IUPAC publications except the scientific journal *Pure and Applied Chemistry*. A leaflet detailing IUPAC books currently available from Blackwell Scientific Publications has recently been distributed by the publishers to all *CI* readers. Further copies may be obtained from the IUPAC Secretariat.

How to contact commissions

IUPAC affiliates are entitled to communicate directly on scientific matters with the officers of IUPAC commissions. A full list of names and addresses of all commission officers for 1994–95 was published in the November 1994 issue of *CI*.

IUPAC-sponsored conferences

If you are interested in attending a conference please apply directly to the conference organizers for the conference circulars and registration forms. An updated list of names and addresses of the organizers of all future IUPAC sponsored conferences is given in the 'Conference Calendar' published in each issue of *CI*.

Ties and scarves

IUPAC ties and scarves may be purchased from the IUPAC Secretariat by applying to the Affiliate Affairs Secretary. The colours for both are *either* maroon *or* navy (dark) blue. The ties cost USD 14.00/GBP 7.00 each and the scarves USD 12.00/GBP 6.00 (including postage and packing).

Please use the form (or a photocopy of it) published on page 24 of the January 1994 issue of *CI*. Alternatively please write to the Affiliate Affairs Secretary with your order stating the colour you require. A cheque made payable to IUPAC for the appropriate amount should be enclosed with your order.

IUPAC poster

Copies of an IUPAC poster are available **free of charge** to affiliates and members of IUPAC's commissions and committees. The poster is printed in maroon and black on a white background and is approximately 42 × 59 cm in size.

IUPAC welcomes any publicity you can give to its activities. If you would like to display one or more copies of the poster in your department or elsewhere please write to the Affiliate Affairs Secretary stating your name and address and how many copies of the poster you wish to receive.

Address of IUPAC Secretariat

Please use the following address for all communications directed to the IUPAC Affiliate Affairs Secretary. If your are submitting a letter for publication in *Chemistry International (CI)*, please indicate that the letter is 'Submitted for publication in *CI*.'

Affiliate Affairs Secretary, IUPAC Secretariat, Bank Court Chambers, 2–3 Pound Way, Templars Square
Cowley, Oxford OX4 3YF, UK.
Tel: +44 (865) 747744; Fax: +44 (865) 747510
E-mail: iupac@vax.oxford.ac.uk

Affiliate reduction of conference registration fees

It is a condition of IUPAC sponsorship of a conference that IUPAC affiliates are entitled to a 10% reduction or 'own members' rate on the registration fee for scientific participants. This concession is usually, but not always, announced in the conference circulars and indicated on the registration form.

To receive this reduction an affiliate must declare on the conference registration form that (s)he is an affiliate. Alternatively the affiliate should apply in writing to the conference organizer for this reduction stating that (s)he is an affiliate. Conference organizers may check with the IUPAC Secretariat that applicants for this reduction are currently registered as affiliates.

If an application for this reduction is refused, an affiliate should immediately notify the Affiliate Affairs Secretary and, if possible, forward copies of documentary evidence of this refusal.

Have you received your affiliate documents?

Every affiliate receiving a copy of the May 1994 issue of *CI* should have found, inserted in the magazine, a white envelope addressed to affiliates. The envelope contained the following documents:

- a letter from the IUPAC Affiliate Affairs Secretary;
- an IUPAC affiliate membership card valid until May 1995;
- an IUPAC affiliate membership certificate;
- an IUPAC affiliate membership registration form to be completed and returned to the IUPAC Secretariat before October 31st, 1994.

If your copy of the magazine did not contain this package of documents *and* you are a registered affiliate for 1994, then please inform the Affiliate Affairs Secretary at the IUPAC Secretariat. Replacement documents will be sent to you.

IUPAC 1993

Maurice Williams

Each year, IUPAC Executive Secretary Dr Maurice Williams prepares a report on IUPAC activities for the International Council of Scientific Unions (ICSU). This is his 1993 report.

The main event for IUPAC in 1993 was its 37th General Assembly, which was held during August at Lisbon University, Portugal. Delegates from 38 of the 43 National Adhering Organizations were in attendance. Accounts of the deliberations are given in *Chemistry International* (Nos. 1–3, 1994).

The IUPAC Officers for the period 1994–95 are:

President – Prof. K. I. Zamaraev (Russia)
Vice-President – Prof. A. E. Fischli (Switzerland)
Past-President – Prof. A. J. Bard (USA)
Secretary General – Prof. G. den Boef (Netherlands)
Treasurer – Prof. J. M. Ward (UK)

Because of arrears in their annual subscriptions, Ethiopia and Yugoslavia ceased to be members of the Union. Croatia and Slovenia became the first of the states, which formerly comprised Yugoslavia, to take up membership. In addition, Czechoslovakia was replaced by the new Czech and Slovak republics. Malaysia changed its status to that of Observer Country, and Latvia, Puerto Rico, Turkmenistan, and Ukraine were also accepted for such status. The Chemical Heritage Foundation was admitted as an Associated Organization and, in the statutory review of existing AOs, 6 of the 37 were discontinued.

Discussions on restructuring the Union reached fruition with general agreement on how to proceed in the near future: a zero-sum titular membership for the Divisions and maintaining important core activities, and establishment of a pool of 18 TMs to deal with emerging areas of chemistry and those requiring urgent attention. Allocations were made from this pool for the next two years, after which the TM-positions must be returned to an enlarged pool of 24. The biennial Vice-Presidential critical assessment of IUPAC programmes and projects provoked lively reactions, and a time schedule was agreed in order to ensure, in future, a satisfactory dialogue within the Union. The Executive Committee will be considering carefully the general remarks and suggestions of Vice-President Staab about IUPAC activities. These developments will hopefully lead to a more flexible structure, in which a desired new momentum for IUPAC can be generated.

Lisbon, venue of the 37th IUPAC General Assembly.

One very rapidly emerging area has been that of fullerene chemistry, and IUPAC set up a working group to formulate recommendations on nomenclature and terminology expeditiously for this field. Despite the difficult problems, good progress was made, and it is hoped to publish recommendations during 1994.

An important decision at the General Assembly was to continue to coordinate the activities of the Union on environmental chemistry. Prof. J. G. Calvert, a main organizer of the CHEMRAWN VII Conference (Chemistry of the Atmosphere: 1991) will undertake this responsibility, which will mean in the first place to see whether there is any overlap in these activities and to identify projects which need urgent treatment by IUPAC. Meanwhile, the second volume on *Environmental Particles* was issued in IUPAC's major new series on *Environmental Analytical and Physical Chemistry*.

Recommendations from the 2nd IUPAC Workshop on Safety in Chemical Production (Yokohama, May–June) were approved by the Bureau at the General Assembly for distribution through IUPAC-channels.

Just a few weeks after the signing of the Chemical Weapons Convention (Paris, January), IUPAC's Task Force on Scientific Aspects of the Destruction of Chemical Warfare Agents held its first meeting. It seeks to identify scientific questions related to the destruction of chemical warfare agents ('poison gases'), which need further investigation by research, and to obtain and disseminate information about potential destruction processes. Also, it wishes to be helpful to authorities faced with chemical munitions destruction problems. Financial support for the Task Force activities are being sought from various sources.

In order to allow the relevant laboratories at Berkeley, Darmstadt, and Dubna to respond, publication of the Phase (ii) report of the IUPAC–IUPAP Transfermium Working Group – *Discovery of the Transfermium Elements* – was deferred by IUPAC from 1992 until mid-1993. The resulting delineation of discovery profiles, which in some cases led to a recommendation for sharing of the credit for discovery, generated some critical responses. However, after detailed examination of the criticisms, the WG found it unnecessary to change its conclusions. The IUPAC Commission on Nomenclature of Inorganic Chemistry now has responsibility to recommend actual names for the transfermium elements.

The first edition of the *International Vocabulary of Basic and General Terms in Metrology* (1987) did not take sufficient account of the needs of chemistry and related fields. This deficiency was remedied by full collaboration of IUPAC with the main international organizations concerned with metrology

Visit of the IUPAC Task on Scientific Aspects of the Destruction of Chemical Warfare Agents to the CBDE destruction facility for old chemical weapons at Porton Down, near Salisbury, UK. (*Photo courtesy CBDE)*

(BIPM, IEC, ISO, and OIML), to produce in 1993 a harmonized interdisciplinary terminology for the second edition ('VIM-2'). This collaboration led also to preparation of the *Guide to the Expression of Uncertainty in Measurement*, which seeks to overcome the lack of international consensus on this vital subject. Significant amongst several important IUPAC publications was the second edition of *Quantities, Units and Symbols in Physical Chemistry* ('The Green Book'), which introduced "chemical amount" as a possible more acceptable alternative to "amount of substance".

Two valuable databases were launched at the General Assembly. IUPAC-Search includes all recommendations and reports published in the journal *Pure and Applied Chemistry* since its inception in 1960. It permits chemists worldwide to find out, via a personal computer, what the Union has said on a given topic. IUPAC was the driving force behind previous critical compilations of literature values for stability constants, and the Stability Constants Database is the natural successor to, and replacement for, the well-known book compilations of metal-complex stability constants. Agreement was reached with Oxford University Press to ensure continued dissemination of the well established *Solubility Data Series* of volumes.

Resources were approved at the UNESCO General Conference to facilitate cooperation with IUPAC in a joint international programme on Chemistry for Life, to be carried out in conjunction with CHEMRAWN. Another feature of the collaboration is the introduction of IUPAC–UNESCO–UNIDO fellowships for safety and environmental protection in chemical, pharmaceutical and biotechnical production for developing countries, and to continue with the Visiting IUPAC Professorships scheme which was finally initiated in mid-1993 with presentations on solid-state chemistry in Argentina and Brazil. A proposal is also under consideration for advancing chemistry in least developed countries. In addition, collaboration on environmental analytical chemistry for developing countries was started through a joint Working Group with the International Organization for Chemical Sciences in Development. The first practical project under investigation is a possible workshop in Ecuador.

Regarding the three 1993 ICSU grants to IUPAC, good progress has been made with the recycling of polymers project, and a report will probably be finalized in 1995. The same applies to the joint projects with IUBMB and IUPAB on the glossary of terms in inorganic biochemistry and on the standardization of databases on protein structures. The grant for chemical interactions in ecosystems has been of very great help in the preparation of a volume in the series on *Environmental Analytical and Physical Chemistry*.

Launch of the IUPAC Stability Constants Database was at the Lisbon General Assembly.

Appendix

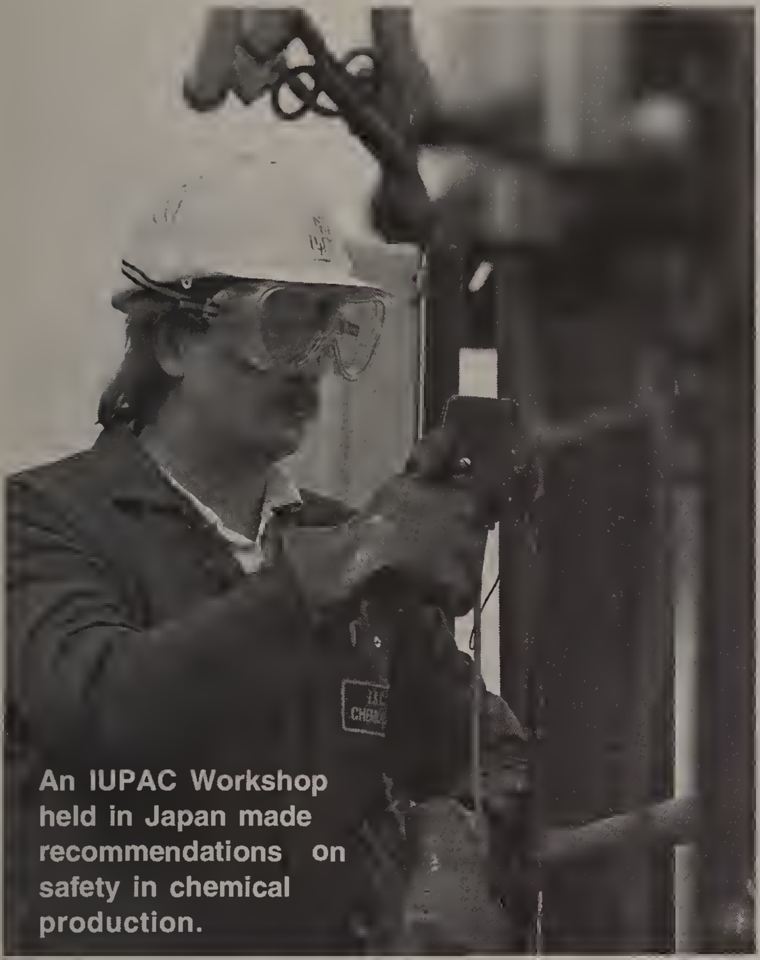
The following nomenclature reports (IUPAC Recommendations 1993) were published during the year:

1. Commissions on Chromatography and Other Analytical Separations and on Analytical Nomenclature, 'Nomenclature for Chromatography', *Pure Appl. Chem.* **65**, 819–872 (1993)
2. Commission on Electrochemistry, 'Nomenclature, Symbols and Definitions in Electrochemical Engineering', *Pure Appl. Chem.* **65**, 1009–1020 (1993)
3. Commission on Nomenclature of Organic Chemistry, 'Revised Nomenclature for Radicals, Ions, Radical Ions and Related Species', *Pure Appl. Chem.* **65**, 1357–1455 (1993)
4. Commission of Macromolecular Nomenclature, 'Nomenclature of Regular Double-strand (Ladder and Spiro) Organic Polymers', *Pure Appl. Chem.* **65**, 1561–1580 (1993)
5. Commission on Toxicology, 'Glossary for Chemists of Terms Used in Toxicology', *Pure Appl. Chem.* **65**, 2003–2122 (1993)
6. Commission of Analytical Nomenclature, 'Nomenclature of Kinetic Methods of Analysis', *Pure Appl. Chem.* **65**, 2291–2298 (1993)
7. Commissions on Chromatography and Other Analytical Separations and on Analytical Nomenclature, 'Nomenclature for Liquid–liquid Distribution (Solvent Extraction)', *Pure Appl. Chem.* **65**, 2373–2396 (1993)
8. Commission on Chromatography and Other Analytical Separations, 'Nomenclature for Supercritical Fluid Chromatography and Extraction', *Pure Appl. Chem.* **65**, 2397–2403 (1993)
9. Commission on Chromatography and Other Analytical Separations, 'Nomenclature and Terminology for Analytical Pyrolysis', *Pure Appl. Chem.* **65**, 2405–2409 (1993)
10. Commission on Chemical Kinetics, 'Kinetics of Composite Reactions in Closed and Open Flow Systems', *Pure Appl. Chem.* **65**, 2641–2656 (1993)
11. Commission on Physicochemical Symbols, Terminology and Units *'Quantities, Units and Symbols in Physical Chemistry'*: 2nd edn. (published in book form by Blackwell Scientific Publications, Oxford, 1993)
12. Commission on Physicochemical Symbols, Terminology and Units *'Abbreviated List of Quantities, Units and Symbols in Physical Chemistry'*: 2nd edn. (published in laminated card form by Blackwell Scientific Publications, Oxford, 1993)

The following technical reports by IUPAC bodies were published during the year:

1. Commission on Food Chemistry, 'Analytical Methods for Post-irradiation Dosimetry of Foods', *Pure Appl. Chem.* **65**, 165–172 (1993)
2. Commission on Microchemical Techniques and Trace Analysis, 'Analytical Techniques for Trace Organic Compounds – IV: Tandem Mass Spectrometry for Organic Trace Analysis', *Pure Appl. Chem.* **65**, 1021–1027 (1993)
3. Commission on Equilibrium Data, 'Critical Survey of Stability Constants of Complexes of Aliphatic Amino Acids', *Pure Appl. Chem.* **65**, 1029–1080 (1993)
4. Commission on Radiochemistry and Nuclear Techniques, 'Radionuclide Migration in Groundwaters: Review of Behaviour of Actinides', *Pure Appl. Chem.* **65**, 1081–1102 (1993)
5. Commission on Polymer Characterization and Properties, 'Intrinsic Characterization of Continuous Fibre Reinforced Thermoplastic Composites – III. A Collaborative Study of Structure and Morphology in Continuous Fibre Reinforced PET and PEEK', *Pure Appl. Chem.* **65**, 1581–1593 (1993)
6. Commission on Water Chemistry, 'Biodegradation and Leaching of Pollutants: Monitoring Aspects', *Pure Appl. Chem.* **65**, 1595–1603 (1993)
7. Transfermium Elements Working Group, 'Discovery of Transfermium Elements – Part II: Introduction to Discovery Profiles; Part III: Discovery Profiles of Transfermium Elements', *Pure Appl. Chem.* **65**, 1757–1814 (1993)
8. Transfermium Elements Working Group (TEWG), Responses from Concerned Laboratories and TEWG Reply to Responses on the Report 'Discovery of Transfermium Elements', *Pure Appl. Chem.* **65**, 1815–1824 (1993)
9. Commission on Polymer Characterization and Properties, 'Molecular Characteristics and Crystalline Structure of Ethylene-dimethylaminoethyl-methacrylate Copolymers' *Pure Appl. Chem.* **65**, 1825–1847 (1993)
10. Commissions on Electroanalytical Chemistry and on Equilibrium Data, 'Recommended Procedures for Calibration of Ion–selective Electrodes', *Pure Appl. Chem.* **65**, 1849–1858 (1993)
11. Commission on Atmospheric Chemistry, 'Use of Diffusive Samplers for Monitoring Ambient Air', *Pure Appl. Chem.* **65**, 1859–1874 (1993)
12. Interdivisional Working Party for Harmonization of Quality Assurance Schemes for Analytical Laboratories, 'International Harmonized Protocol for Proficiency Testing of (Chemical) Analytical Laboratories', *Pure Appl. Chem.* **65**, 2123–2144 (1993)
13. Commission on Agrochemicals, 'Use of Isolated Cells to Study Metabolism of Agrochemicals in Animals', *Pure Appl. Chem.* **65**, 2299–2312 (1993)
14. Commission on Microchemical Techniques and Trace Analysis, 'Depth of Origin of Sputtered Atoms', *Pure Appl. Chem.* **65**, 2361–2372 (1993)
15. Commission on Electrochemistry, 'Mutual Diffusion Coefficients in Aqueous Electrolyte Solutions', *Pure Appl. Chem.*

IUPAC continues to collaborate with UNESCO. For example the Visiting IUPAC Professorships scheme is supported by UNESCO and a joint IUPAC-UNESCO programme for advancing chemistry in least developed countries was initiated in 1993.



An IUPAC Workshop held in Japan made recommendations on safety in chemical production.

65, 2613–2640 (1993)

16. Commission on Thermodynamics, International Thermodynamic Tables of the Fluid State: Vol. 12: '*Methanol*' (published in book form by Blackwell Scientific Publications, Oxford, 1993)
17. Commission on Solubility Data, Solubility Data Series: Vol. 53: *'Cumulative Index for Vols. 40–52'* (published in book form by Pergamon Press, Oxford, 1993)
18. Commission on Environmental Analytical Chemistry, Environmental Analytical and Physical Chemistry Series: *'Environmental Particles – Vol. 2'* (published in book form by Lewis Publishers, Boca Raton, 1993)

Twenty-four symposia were sponsored by IUPAC in 1993, namely:

1. 3–6 January 1993. International Conference on Thermodynamics of Solutions and Biological Systems, New Delhi, India. [*Pure Appl. Chem.* **66**, (3) 1994]
2. 19–22 January 1993. International Recycling Congress, Geneva, Switzerland. (Arrangement for publication of proceedings being made by organizers)
3. 9–12 January 1993. 3rd International Symposium on Protein Structure – Function Relationship, Karachi, Pakistan. [*Pure Appl. Chem.* **66**, (1) 1994]
4. 9–12 May 1993. 3rd International Symposium on Characterization of Porous Solids, Marseille, France. (Proceedings to be published by Elsevier, Amsterdam, 1994)
5. 11–13 May 1993. International Environment 93 with Analysis 93, London, UK. (No publication expected)
6. 31 May – 4 June 1993. 2nd IUPAC-Workshop on Safety in Chemical Production, Yokohama, Japan. (Proceedings to be published by Blackwell Scientific Publications, Oxford, 1994)
7. 6–10 June 1993. 2nd International Symposium on Bioorganic Chemistry, Fukuoka, Japan. [*Pure Appl. Chem.* **66**, (4) 1994]
8. 20–25 June 1993. 10th International Symposium on Carotenoids, Trondheim, Norway. [*Pure Appl. Chem.* **66**, (5) 1994]
9. 24–30 June 1993. 6th International Conference on Multiphoton Processes, Quebec, Canada. (No publication expected)
10. 27 June – 2 July 1993. 18th International Symposium on Macrocyclic Chemistry, Enschede, Netherlands. [*Pure Appl. Chem.* **65**, (11) 1993]
11. 29 June – 4 July 1993. 28th Colloquium Spectroscopicum Internationale, York, UK. (Proceedings to be published in *The Analyst* and *J. Anal. Atomic Spectro.* by UK Royal Society of Chemistry, Cambridge, 1994)
12. 5–8 July 1993. 11th International Symposium on Cationic Polymerization and Related Ionic Processes, Borovets, Bulgaria. (Proceedings to be published as a *Macromolecular Symposia* volume by Hüthig & Wepf Verlag, Basel, 1994)
13. 11–15 July 1993. 8th International Meeting on Boron Chemistry, Knoxville, TN, USA. [*Pure Appl. Chem.* **66**, (2) 1994]
14. 12–15 July 1993. 33rd Microsymposium on Macromolecules: Optics and Dynamics of Polymers, Prague, Czech Republic. (Proceedings to be published as a *Macromolecular Symposia* volume by Hüthig & Wepf Verlag, Basel, 1994)
15. 1–6 August 1993. 14th International Congress on Heterocyclic Chemistry, Antwerp, Belgium. (Plenary/invited lectures to be published in *J. Heterocyclic Chem.)*
16. 8–14 August 1993. International Conference on Applications of Mössbauer Effect, Vancouver, Canada. (Proceedings to be published in *Hyperfine Interactions*, 1994)
17. 15–21 August 1993. 23rd International Conference on Solution Chemistry, Leicester, UK. [*Pure Appl. Chem.* **65**, (12) 1993]
18. 15–20 August 1993. 34th IUPAC Congress, Beijing, China. (Plenary lectures to be published in *Pure Appl. Chem.*, 1994)
19. 15–20 August 1993. 10th International Symposium on Organosilicon Chemistry, Poznan, Poland. (Proceedings to be published by Gordon & Breach, New York, 1994)
20. 23–27 August 1993. 11th International Symposium on Plasma Chemistry, Loughborough, UK. (Main lectures to be published in *Pure Appl. Chem.*, 1994)
21. 30 August – 3 September 1993. 5th International Symposium on Macromolecule–Metal Complexes, Bremen, Germany. (Proceedings to be published as a *Macromolecular Symposia* volume by Hüthig & Wepf Verlag, Basel, 1994)
22. 5–11 September 1993. Euroanalysis 8, Edinburgh, UK. (Proceedings to be published by UK Royal Society of Chemistry, Cambridge, 1994)
23. 6–10 September 1993. International Conference on Advanced Polymer Materials, Dresden, Germany. (Proceedings to be published as a *Macromolecular Symposia* volume by Hüthig & Wepf Verlag, Basel, 1994)
24. 19–23 September 1993. 7th International Symposium on Organo-metallic Chemistry Directed Toward Organic Synthesis, Kobe, Japan. (Main lectures to be published in *Pure Appl. Chem.*, 1994)

IUPAC Accounts for 1993

The audited IUPAC accounts for 1993 are preceded by the comments of the IUPAC Treasurer Prof. John Ward and the auditors' report.

Treasurer's comments

After several years of substantial deficits it is encouraging to see from the Summary of Income and Expenses that in 1993 the Union made a small surplus (USD 22 629). The result is the more pleasing when it is compared with the budgeted deficit of USD 100 500. Although part of the difference is the result of stringent control of expenses together with some good fortune, an almost equal part arises from our accounting policy of allocating the total biennial expenses of IUPAC bodies (Divisions/Section and Standing Committees) to the even year. Nevertheless, the result is a strong indication that our finances are coming under control.

The major reduction in expenses - almost USD 65 500 - came from the Lisbon General Assembly. It will be recalled that at the beginning of 1993, there was much concern that we would not be able to contain costs within budget; the reasons were the marked rise in the cost of hotel accommodation and the falling rate of exchange between the US dollar and the Portuguese escudo. By dealing directly with a few of the largest hotels in Lisbon we were able to secure very favourable rates and by putting in place various measures to reduce overheads, such as paying all subsistence in escudos at the Assembly, we were able to make substantial savings. By no means the least of the effort came from the Titular Members who cooperated to the full in keeping travel and subsistence costs to a minimum. Then, most fortunately, a month or two before the Assembly the US dollar strengthened and the Portuguese escudo was slightly devalued which led to everyone having sufficient currency for a comfortable time without the need to dip into their own resources.

Other contributions to the surplus were the Secretariat, which was USD 32 000 below budget, and USD 14 700 unspent from the contingency fund (Other Expenses). The good financial performance of the Secretariat was in part due to the USD/GBP exchange rate being in our favour. This is not to denigrate their efforts, but rather to warn that it is difficult to reduce the expenses of the Secretariat when so many of the costs are fixed and are subject to inflation. However, the newly introduced system of management accounting is ensuring strict monitoring and control. Other positive but smaller items were a saving of USD 4 600 in Officers' Expenses and USD 6 700 in sending representatives to meetings of other organizations. Lastly, the performance of Publications which made a return USD 8 600 over budget must be applauded when one recalls the difficult times still being experienced all over the publishing world.

The principal negative items were an overspend of USD 9700 on the Affiliate Membership Programme; provision of USD 15 700 for the *IUPAC Handbook*, caused by having to transfer this cost from 1992; an overspend of USD 12 600 on Audit and Bank Fees, and a difference of USD 22 400 in income from Interest & Dividends. The disparity in the figure for audit and bank fees comes about largely because in preparing the budget we underestimated the increase in charges for banking and investment management that would result from our now having to pay the Union Bank of Switzerland in full for these. The undershoot in income from interest and dividends is disappointing given the returns made by many investment managers in 1993. The Finance Committee is giving close attention to the possibility of moving the IUPAC investment portfolio to another firm of managers.

Now let me return to the effect on the odd year account of the customary Union policy of allocating the total biennial monies for IUPAC bodies to the even year. If the 1993 budget as it stood is compared with the actual expenses and income, the result is a deficit of USD 33 200, a difference of USD 55 800 from the figure in the accounts. The difference comes about because at the end of the even year, unspent monies by IUPAC bodies are entered in the accounts as a provision for the next year and so have no effect on the even year reconciliation between budget and accounts. Any of that provision not spent in the odd year then effectively becomes an added item of unbudgeted income and so distorts that reconciliation. In 1992, USD 187 700 was unspent and was available in 1993; but only USD 131 900 was used leaving an effective addition of USD 55 800 to income. If this figure is added to that of the budget/account reconciliation USD 33 200, the result is USD 22 600, the figure in the accounts.

This is not a new occurrence and the odd year figures have shown similar differences in the past. The average percentage of the biennial allocation to IUPAC bodies spent in the first year of recent biennia is about 70; consequently the Finance Com-

Auditor's Report

The following is the Report of the Auditors to the IUPAC Executive Committee:

As auditors of the International Union of Pure and Applied Chemistry we have examined the books of account and accounts for the year ended 31 December 1993. Our audit was conducted in accordance with auditing standards promulgated by the profession. We confirm that we meet the legal requirements concerning professional qualification and independence.

Based on our examination, we conclude that the books of account and the accounts are in accordance with Swiss law and the requirements of the statutes.

We recommend that the accounts submitted to you be approved.

NEUTRA TREUHAND AC
Zurich, 22 April 1994

mittee has accepted my recommendation that in future 70% of the biennial allocation is entered in the even year budget and 30% in the odd year budget. It will have the effect of showing a substantial surplus in the even year and an equal deficit in the odd year if we succeed in balancing the biennial budget. The adoption of this method will give a more accurate reconciliation between budgets and accounts and a truer picture of annual finances. It will have no effect on the even/odd biennial reconciliation.

This biennial even/odd reconciliation and the final figures are the realistic ones; and for the 1992-1993 biennium, the actual outcome is a deficit of USD 49 800 compared with a budgeted deficit of USD 100 500. This must be regarded as a further encouraging indication that our financial situation is improving. The budgeted deficit for the present biennium 1994-1995 is USD 58 500 and at the end of 1995 I hope we shall see that the actual figure is nearer to zero. There is a real chance that it will be so if we all continue our efforts to be economical and efficient. Even so, we would all like to see the Divisions/Section using all their allocated monies - but economically and effectively. USD 29 500 was not spent in 1992–93.

One does not wish the same for Standing Committees. An underspend here is a real gain; it was USD 13 600 in 1992–93.

I must emphasize again though that if our scientific work is to be maintained at the present level, our accounts will only balance if we can increase our income. If the chemical and allied industries were truly aware of the value to them of the results of our work then I believe many more companies would become Company Associates or would increase their subscriptions.

Industry will be approached shortly with brief accounts of our work and its value in the form of attractive brochures which it is hoped will persuade them to do so. May I also repeat that if National Adhering Organizations were to pay their subscriptions on or near the due date, 1 January, we could earn more interest to add to our income. There was a small improvement in 1993, but even so, six months after the due date, only 44% of the total subscriptions had been paid.

Despite our difficulty in balancing income and expenditure, our underlying financial position remains strong. Our total financial assets fell a little during the year, from USD 2 472 500 to USD 2 411 200, but are still just above the target value – the value of the expenses of the last two years.

IUPAC Accounts 1993 (expressed in USD)

Comparative Balance Sheet

Liabilities		Assets	
Capital Account	2 321 263	Fixed Assets[5]	42 429
Accounts Payable[1]	49 327	Cash in Banks[6]	45 718
Paulo Franzosini Fund	5 659	Marketable Securities at Cost	2 035 935
Provisions & Subaccounts[2]	120 727	Building Fund (held in GBP)[7]	332 959
Prepaid Subscriptions[3]	1 000	Accounts Receivable[8]	12 815
Sundry Creditors	13 787	Sundry Debtor	25 910
Capital Gains Realized[4]	45 911	Subscriptions, etc., Outstanding[9]	84 537
Excess of Income over Expenses	22 629	Excess of Expenses over Income	
	2 580 303		2 580 303

Summary of Income and Expenses

General Expenses net	–116 246
Publications Income net	148 529
Affiliate Membership Programme Expenses net	–9 654
To Capital Account	22 629

General Income and Expenses

Income		Expenses	
National Subscriptions[10]	560 310	Office Expenses[14]	308 952
Company Associate Service Charges[11]	9 200	Expenses IUPAC Bodies[15]	131 875
Observer Country Service Charges[12]	750	General Assembly	454 537
Associated Organization Service Charges[13]	1 700	Bad Debts Write Off[16]	30 095
Interest & Dividends Earned	117 578	Bad Debts Provision	–29 000
Other Income	0	Other Expenses[17]	82 910
Debit to Capital Account	116 246	Foreign Exchange Differences	–869
		Depreciation	14 968
	805 784	Provisions: Committed Expenses	–187 684
			805 784

Publications Income and Expenses

Income		Expenses	
Publications: Blackwell	323 025	Secretariat (Publications)	170 439
Publications: Pergamon	0	Chem. Intl. to Symposia	688
Publications: Other Publishers	8 297	Pergamon Payments against Royalties	0
Publications: Secretariat	137	Miscellaneous Expenses[18]	31 803
BSP Support of Publication Activities	20 000	Credit to Capital Account	148 529
	351 459		351 459

Affiliate Membership Programme Income and Expenses

Income		Expenses	
Contributions[19]	55 336	IUPAC Secretariat	31 001
Royalties Blackwell	7 010	Chem. Intl. & Leaflets	53 108
Ties & Scarves	135	IUPAC Information	0
Transfer from General Income & Expenses	15 000	Miscellaneous Expenses	3 026
Debit to Capital Account	9 654		87 135
	87 135		

Notes to Accounts

1. *Accounts Payable*

List Oxford	34 852
List Zürich	14 475
	49 327

2. *Provisions and Subaccounts*

Committed Expenses	0
Bad Debts	19 994
CHEMRAWN Conference Loan Fund	12 781
Neutra Examination	8 000
Solubility Data Series	0
History of IUPAC	20 000
Purchases from Blackwells/ Pergamon	1 311
Royal Society Contbn. to Dev. Activs.	15 845
Kratos Grant	136
ICSU Grants	19 540
UNESCO Grants	0
Lewis Publishers	3 004
Organic Synthesis	1 523
Destruction of Chemical Warfare	18 593
	120 727

3. *Prepaid Subscriptions*

IZA AO 1994	100
Korea - 2 CAs 1994	900
	1 000

4. *Capital Gains Realized*

Capital Gains Realized	45 911
Foreign Exchange Differences	0
	45 911

5. *Fixed Assets*

Fixed Assets	78 878
Depreciation of Assets over 5 Years	–36 449
	42 429

6. *Cash in Banks*

USD	26 237
GBP	14 944
CHF	1 215
DEM	948

East European Banks (revalued at 91.12.31 using relevant exchange rates for national currency to USD; no exchange rates available at 92.12.31 or 93.12.31)

Bulgaria	44
Czechoslovakia	517
Hungary	545
Poland	1 268
	45 718

7. *Building Fund*

On the recommendation of the IUPAC Council (Minute 7/91, 36th Meeting – Hamburg), part of the Union's assets have been moved into a building fund, to provide for the eventuality that the need for a permanent Secretariat building becomes pressing

8. *Accounts Receivable*

List Oxford	11 815
List Zürich	1 000
	12 815

9. *Subscriptions, etc., Outstanding*

National Organizations	83 837
Observer Country Service Charges	50
Company Associates Service Charges	650
	84 537
National Organizations (1992)	
Egypt	3 800
Greece	2 400
	6 200
National Organizations (1993)	
Belgium	16 800
Chile	1 800
China/Beijing	200
Egypt	4 100
Greece	2 600
Ireland	4 200
Japan	29 487
Korea	11 000
Turkey	3 150
UK	4 300
	77 637
Service Charges Observer Countries (1993)	
Peru	50
Service Charges Company Associates (1993)	
UK	650

10. *National Subscriptions*

Received	482 673
Outstanding	77 637
	560 310

11. *Company Associate Service Charges*

Received	8 550
Outstanding	650
	9 200

12. *Observer Country Service Charges*

Received	700
Outstanding	50
	750

13. *Associated Organization Service Charges*

Received	1 700

14. *Office Expenses*

IUPAC Officers	3 353
IUPAC Secretariat (Non-pubns.)	260 020
Audit, Bank Fees, Other Charges	45 579
	308 952

15. *Expenses IUPAC Bodies*

Administration Expenses	35 725
Meetings other than General Assembly	96 150
General Assembly	454 537
	586 412

16. *Bad Debts Write Off*

Bulgaria (1991)	5 100
Bulgaria (1992)	2 200
Nigeria (1991)	2 400
Nigeria (1992)	2 300
Ethiopia (1990)	400
Ethiopia (1991)	400
Ethiopia (1992)	400
Peru (1990)	2 100
Peru (1991)	2 000
Yugoslavia (1990)	3 550
Yugoslavia (1991)	4 500
Yugoslavia (1992)	4 500
USA CAs (1991)	245
	30 095

17. *Other Expenses*

Contributions to ICSU	18 807
Representatives Other Organizations	8 313
IUPAC Handbook 1989–91	15 660
Chem. Intl. for Members	20 970
Miscellanous Expenses	4 601
Transfer to CHEMRAWN Account	–441
Transfer to Affiliates in Developing Countries	15 000
	82 910

18. *Miscellaneous Expenses*

BSP Travel Grant	28 251
Other	3 552
	31 803

19. *AMP Contributions*

In USD	55 063
From East Europe	273
	55 336

Securities Account as at 31st December 1993

	Currency	Amount	Approx. price %	Approx. value (USD)	Book value at cost (USD)	Profit/(loss) since purchase (USD)
Bonds						
6.5% Toyota	USD	100000	103.88	103875.00	97009.72	6865.28
6 3/8% ABB Internat Finance	USD	100000	103.25	103250.00	97634.38	5615.62
6.75% Philip Morris Capital Account	USD	100000	104.13	104125.00	96988.75	7136.25
7% Chubu Electric Power Co. Inc	USD	100000	104.63	104625.00	99019.44	5605.56
4% Sandoz Overs Fin 1991-30.9.1998	USD	150000	94.00	141000.00	134562.78	6437.22
5 7/8% Euro Ciba-Geigy 1993-23.3.2000	USD	100000	100.75	100750.00	100260.00	490.00
7% Export Dev Corp 1993-25.3.1998	CAD	150000	103.88	117200.60	120526.37	–3325.76
6.5 % Sweden 1993-4.3.2003	USD	100000	102.25	102250.00	101212.78	1037.22
5.5% General Electric 1993-8.4.1998	USD	150000	100.38	150562.50	152280.56	–1718.06
Parts UBS Bond Invest DM Capitalisation	DEM	1000	110.92	63923.13	59831.10	4092.03
5.75% Osaka Gas 1993-26.5.1998	USD	100000	100.88	100875.00	104428.40	–3553.40
5 1/8% Wal-Mart Stores Inc 1993-22.10.98	USD	150000	98.38	147562.50	149497.05	–1934.55
Sub-Total Bonds				1339998.70	1313251.33	26747.41
Shares						
Shs AMCA	CHF	5750	50.30	195287.61	177097.25	18190.36
Shs GERMAC	CHF	200	280.00	37811.76	31327.24	6484.52
Shs Brit Invest	CHF	500	166.25	56126.84	53737.80	2389.04
Shs Francit	CHF	250	233.75	39457.58	34886.20	4571.38
Shs Japan Invest	CHF	300	238.50	48311.28	49773.68	–1462.40
Shs Pacific Invest	CHF	250	564.25	95246.81	67866.45	27380.36
Shs Canac	CHF	1000	86.30	58270.62	57029.18	1241.44
Shs Fonsa	CHF	100	346.50	23396.03	23027.19	368.84
Shs UBS Asia New Horizon	CHF	500	106.70	36022.45	35229.44	793.01
Parts UBS Money Market Invest USD Luxem	USD	190	1004.96	190942.43	192708.97	–1766.57
Shs Sterling Invest - Building Fund	GBP	786	235.25	273737.49	286828.73	–13091.30
Shs Brit Invest - Building Fund	CHF	408	166.25	45799.49	46130.37	-330.88
Sub-Total All Shares				1100410.30	1055642.50	44767.80
Grand Total Securities				2440409.04	2368893.83	71515.21

Molecular mobility and order in polymer systems St. Petersburg, Russia 3–6 October 1994

The International Symposium on Molecular Mobility and Order in Polymer Systems will be organized by the Institute of Macromolecular Compounds, Russian Academy of Sciences, and held in St. Petersburg on 3–6 October 1994. St Petersburg is one of the most beautiful cities in the world. The House of Scientists of St. Petersburg (the former Grand Duke's palace) has been chosen as the venue for the symposium.

The aim of the symposium is to discuss the modern problems of the dynamics in polymer systems with 'soft' order preserving a pronounced molecular mobility. The influence of ordering on the molecular mobility in different polymer systems will be discussed. The main topics of the symposium will be:

- Macromolecules in solutions, melts and networks oriented and stretched in strong external fields.
- Liquid crystalline polymers.
- Block-copolymers.
- Polymer layers and micelles.

The symposium programme will include 24 invited lectures of 25 minutes and posters sessions. The working language of the symposium will be English. No translation service will be provided.

The registration fees before/after 1 August will be USD 300/330 for participants, USD 100/110 for students and USD 50 for accompanying persons. IUPAC affiliate members are entitled to a 10% reduction. The registration fee for scientists from Eastern European countries has been reduced to the student level.

The House of Scientists, St. Petersburg.

Various social events are planned for accompanying persons: sightseeing tours of the city and its suburbs, an excursion to the world-famous museum 'The Hermitage', and theatre performances.

Accommodation for participants will be available at a variety of hotels and a student hostel.

The city is situated on the same latitude as Helsinki and Oslo. It has a humid maritime climate. In October, the weather in St. Petersburg is usually unsettled. However, October may be surprisingly calm with sunny spells. In this weather, St. Petersburg is very beautiful as the sunshine plays on the gilt spires and cupolas and the warm colours of the northern autumn flood the city's gardens, parks and streets.

Toxicology and clinical chemistry of metals British Columbia, Canada 10–13 July 1995

The 5th COMTOX Symposium on Toxicology and Clinical Chemistry of Metals will be held at the University of British Columbia, Vancouver, between the 7th International Congress of Toxicology in Seattle, Washington, USA and the American Association for Clinical Chemistry meeting in Anaheim, California.

The symposium will resemble previous COMTOX Symposia on Metals (Monte Carlo, 1977; Montreal, 1983; Kitakyushu, 1986; Helsinki, 1990) which were attended by 300–500 scientists and physicians with expertise in toxicology, clinical chemistry, analytical chemistry, pathology, metabolic disorders, occupational and environmental health, and nutrition. The programme will emphasize cross-disciplinary relations and promote participant interactions. It will include plenary lectures, platform sessions, analytical workshops, posters with discussion, and commercial exhibits. English will be used for oral presentations and printed materials.

The four major themes of the scientific programme are:

1 *Molecular biology and toxicology of metals:* Cellular entry and subcellular translocation of metals; metal-binding to macromolecules and diffusible ligands, metallothionein and its isoforms; metals in cell division, gene replication and transcription; metal-induced free radical reactions; mechanisms of metal genotoxicity, carcinogenesis, and teratogenesis.

2 *Analysis of metals in biological materials:* Inductively coupled plasma mass spectrometry and atomic emission spectroscopy; electrothermal atomic absorption spectrometry; neutron activation analysis and related techniques; electron microprobe analysis; voltammetry and related techniques; metal speciation by high performance liquid chromatography; capillary electrophoresis with metal-sensitive detectors;

COMTOX local organizing committee (from left): F. William Sunderman Jr; Anne P. Autor; Robert L. Thies; Gillian Lockitch; Peter F. Stonier; and Robert Brown.

metal receptor isolation by metal-affinity chromatography; Western blots with metal radioprobes; reference methods and materials; interlaboratory harmonization.

3 *Metals in health and disease*: Metal absorption, distribution, and kinetics; animal models; nutritional essentiality; dietary requirements; reference values for metals in body fluids and tissues; toxicity for brain, liver, kidney, heart, lung, bone, and skin; haematological, immunological, endocrine, and reproductive effects; interactions of essential and toxic trace metals, genetic disorders of metal metabolism; inter-individual variation in susceptibility to metal toxicity; metal accumulation in organ insufficiency; metal compounds as drugs and chemotherapeutic agents; chelation therapy of metal overload.

4 *Occupational and environmental exposures*: Chemical and biological monitoring of metal exposures from occupational, environmental, and iatrogenic sources; metal release from dental and orthopaedic prostheses; biomarkers of metal toxicity and carcinogenesis; epidemiological studies.

Social events for participants will include a reception at the Faculty Club, a banquet at the Museum of Anthropology, and a harbour cruise with salmon barbecue. Visits to Vancouver's famous museums, art galleries, parks and gardens will be arranged for accompanying persons.

Vancouver is a festive, cosmopolitan city (population 1.3 million), with fashionable shops, sidewalk cafes, seaside markets, stately mansions, formal gardens, ultramodern skyscrapers, and myriad cultural and outdoor activities. The scenery of British Columbia is spectacular, with rolling hills, dense forests, high-walled canyons, majestic mountains, sandy beaches, lovely islands, and abundant wildlife. The weather in July is generally mild and pleasant.

Chromatographic and electrophoretic techniques

The International Symposium on Chromatographic and Electrophoretic Techniques, organized by the Analytical Division of the Slovenian Chemical Society, will be held at Hotel Toplice in the Alpine resort of Bled, Slovenia, 10–13 October. The Symposium is one of a series of conferences dealing with modern separation techniques, started in the early 1970s at the Plitvice Lakes, Croatia. Since 1988, the meetings have alternated between Slovenia and Croatia.

The Symposium will cover all aspects of chromatography and electrophoresis as well as related techniques and applications in various fields of research and industry. The Symposium language will be English.

For further information, please contact Dr. M. Prošek, National Institute of Chemistry, SLO-Ljubljana, Slovenia. Fax: +386 (61) 12 59 244.

Challenges in polymer science and technology

The 5th International Polymer Conference – Challenges in Polymer Science and Technology (IPC 94) will take place at the Senri Life Science Center, Osaka, Japan, 28 November – 2 December 1994. There will be 14 main lectures and about 60 invited lectures together with around 300 contributed papers.

The general topics are:

- Polymer synthesis and reactions.
- Polymer structure and characterization.
- Physical properties of polymers.
- Polymer processing.
- Functional polymers.
- High performance polymers.

In addition, there will be eight selected topics: Recent advances in olefin polymerization; Polysilanes and silicon containing polymers; Optically active polymers; Bio- and bio-related polymers; Computer modelling of polymer systems; Surface modification of polymers; Polymer particles; and Polymers for photonics.

For further information, please contact: IPC 94 Secretariat, The Society of Polymer Science, Japan, Nagaoka Building, 1-2-2 Tsukiji, Chuo-ku, Tokyo 104, Japan. Tel: +81 (3) 3543 3765. Fax: +81 (3) 3545 8560.

New aspects of organic chemistry

The scientific programme of the 6th International Kyoto Conference on New Aspects of Organic Chemistry (IKCOC-6) will cover all aspects of organic syntheses of current interest, and will include plenary lectures, invited lectures, and contributed papers. The conference will take place at the Park Hotel, Kyoto, Japan, 7–11 November 1994.

The conference will be devoted to advances in organic synthesis will special emphasis on the following topics:

1 Efficiency in organic synthesis (plenary lecturer: Prof. R. Noyori, Nagoya University).
2 Organic synthesis for materials science (plenary lecturer: Prof. F. Wundl, University of California, Santa Barbara).
3 Organic synthesis for life science (plenary lecturer: Prof. S. L. Schreiber, Harvard University).

All correspondence should be sent to: Prof. Yoshihiko Ito, Chairman, IKCOC-6, Department of Synthetic Chemistry, Kyoto University, Yoshida, Kyoto 606-01, Japan. Fax: +81 (75) 753 5668.

Catalysts in petroleum refining and petrochemicals industries

The 2nd International Conference on Catalysts in Petroleum Refining and Petrochemical Industries will be held in Kuwait, 22–26 April 1995. The following are the topics of the conference:

- Catalyst characterization techniques and/or correlation of catalyst performance and characteristics.
- Novel developments and improvements in hydroprocessing and FCC catalysts.
- Deactivation of catalysts and new developments in spent catalyst disposal.
- New developments in hydroprocessing & FCC technology.
- New developments in thermal and catalytic hydrocracking technologies.
- Industrial experience in petroleum refining.
- New developments in olefins polymerization catalysts & technology.
- Structural analysis of petroleum heavy distillates & residues.

For more information, please contact: Dr Jasem Al-Beshara, Organizing Committee Chairman, Catalysts in Petroleum Refining & Petrochemical Industries Conference, Kuwait Institute for Scientific Research, PO Box 24885 Safat/13109 Kuwait. Tel: +965 4834818. Fax: +965 4834910.

Conference Calendar

1994

Pesticide chemistry

4–9 July
8th International Congress of Pesticide Chemistry. Washington, DC, USA.
Dr. J. R. Plimmer, ABC Laboratories, 7200 ABC Lane, PO. Box 1097, Columbia, MO 65205, USA.

Inorganic membranes

10–14 July
3rd International Conference on Inorganic Membranes. Worcester, MA, USA.
Prof. Y. H. Ma, Department of Chemical Engineering, Worcester Polytechnic Institute, 100 Institute Road, Worcester, MA 01609-2280, USA.

Macromolecules

11–15 July
35th International Symposium on Macromolecules. Ohio, USA.
Macroakron '94, Cathy Manus-Gray, Symposium Coordinator, Institute of Polymer Science, The University of Akron, Akron, OH 44325-3909, USA. Tel: +1 (216) 9725334. Fax: +1 (216) 9725463. E-Mail:Manusgray@UAkron

Chemical thermodynamics

17–22 July
13th International Conference on Chemical Thermodynamics. Clermont-Ferrand, France.
Prof. J.-P. E. Grolier, Laboratoire de Thermodynamique et Génie Chimique, Université Blaise Pascal, Clermont-Ferrand, F-63177 Aubière Cédex, France. Tel: +33 73407186. Fax: +33 73407185.

Carbohydrates

17–22 July
17th International Carbohydrate Symposium. Ottawa, Canada.
Dr. H. Jennings, Institute of Biological Sciences, National Research Council of Canada, 100 Sussex Drive, Ottawa, Ontario, Canada, K1A OR6.

Photochemistry

17–22 July
15th IUPAC Symposium on Photochemistry. Prague, Czech Republic.
Prof. I. Stibor, Prague Institute of Chemical Technology (PICT), Department or Organic Chemistry, Technická 5, 166 28 Prague 6, Czech Republic. Tel: +42 (2) 3111790. Fax: +42 (2) 3119919. E-mail: stibori@vscht.cs

Prague: venue of the 15th IUPAC Symposium on Photochemistry.

Excitonic processes in condensed matters

19–22 July
International Conference on Excitonic Processes in Condensed Matters. Darwin, Australia.
Dr. J. Singh, EXCON 94, Faculty of Science, Northern Territory University, PO. Box 40146, Casuarina, NT 0811, Australia. Tel: +61 (89) 466811. Fax: +61 (89) 410460. E-mail: singhjai@darwin.ntu.edu.au

Local air pollution

20–21 July 1994
International Workshop on Local Air Pollution in Rapidly Developing Countries. Zhen De, Beijing, China.
Prof. Xiaoyan Tang, Center of Environmental Sciences, Peking University, Beijing 100871, China. Tel: +86 (1) 2501925. Fax: +86 (1) 2501927. E-mail: TangXY@BEPC2@SCS.SLAC.STANFORD.EDU

Coordination chemistry

24–29 July
30th International Conference on Coordination Chemistry. Kyoto, Japan.
Prof. H. Ohtaki, Laboratories of Coordination Chemistry, Institute for Molecular Science, Myodaiji-cho, Okazaki 444, Japan.

Polymer networks 94

25–29 July
35th Microsymposium on Macromolecules. Prague, Czech Republic.
35th Microsymposium, P.M.M. Secretariat, c/o Institute of Macromolecular Chemistry, Academy of Sciences of the Czech Republic, Heyrovsky Sq. 2, 162 06 Prague 6, Czech Republic. Tel: +42 (2) 360341. Fax: +42 (2) 367981. E-mail: SYMPO@IMC.CAS.CZ. Telex: 122019 imcp c.

Chemical education

8–12 August
13th International Conference on Chemical Education. Chemistry: The Key to the Future. Puerto Rico.
Dr. Ram S. Lamba, Metropolitan Campus, Inter American University of Puerto Rico, PO. Box 191293, San Juan, PR 00919-1293, Puerto Rico. Tel: +1809 2508379. Fax: +1809 7652055 or +1809 2500742. E-mail: rlamba@inter.ui.clu.edu

Raman spectroscopy

22–26 August
14th International Conference on Raman Spectroscopy. Hong Kong.
Prof. Nai-Teng Yu, Department of Chemistry, The Hong Kong University of Science & Technology, Clear Water Bay, Kowloon, Hong Kong. Tel: +852 3587358. Fax: +852 3581594. E-mail: ICORS@USTHK.BITNET

Solubility phenomena

22–26 August
6th International Symposium on Solubility Phenomena. Buenos Aires, Argentina.
Dr. Angela F. Danil de Namor, Department of Chemistry, University of Surrey, Guildford, Surrey, UK. Tel: +44 (483) 509581. Fax: +44 (483) 300803/571035.

Physical organic chemistry

28 August – 2 September
12th International Conference on Physical Organic Chemistry. Padova, Italy.
Prof. F. Di Furia, Department of Organic Chemistry, Via Marzolo 1, I-35131 Padova, Italy. Tel: +39 (49) 831297. Fax: +39 (49) 831222. E-mail POC12@CHOROO.UNIPD.IT

Visas

It is a condition of sponsorship that organizers of meetings under the auspices of IUPAC, in considering the locations of such meetings, should take all possible steps to ensure the freedom of all bona fide chemists from throughout the world to attend irrespective of race, religion, or political philosophy.

IUPAC sponsorship implies that entry visas will be granted to all bona fide chemists provided application is made not less than three months in advance. If a visa is not granted one month before the meeting the IUPAC Secretariat should be notified without delay by the applicant.

Macrocyclic ligands

29 August – 1 September
2nd International Symposium on Macrocyclic Ligands for the Design of New Materials. Buenos Aires, Argentina.
Dr. Angela F. Danil de Namor, Department of Chemistry, University of Surrey, Guildford, Surrey GU2 5XH. Tel: +44 (483) 509581. Fax: +44 (483) 300803/571035.

Liquid crystal polymers

6–9 September
International Conference on Liquid Crystal Polymers. Beijing, China.
Prof. Xibai Qiu, Chinese Chemical Society, PO. Box 2709, Beijing 100080, China.

Thermal analysis and calorimetry

11–16 September
6th European Symposium on Thermal Analysis and Calorimetry (ESTAC). Grado, Italy.
ESTAC 6 – Prof. A. Cesàro, Dip. BBCM, University of Trieste, I-34127 Trieste, Italy. Tel: +39 (40) 6763684. Fax: +39 (40) 6763691. E-mail: CESARO@UNIV.TRIESTE.IT.

Geotoxicology

18–22 September
International Conference on Geotoxicology: Mutagens and Clastogens in the Environment. Oxford, UK.
Dr. Katherine J. Kaye, School of Geography, University of Oxford, Mansfield Road, Oxford, OX1 3TB, UK. Tel: +44 (865) 271929. Fax: +44 (865) 271929.

Medicinal chemistry

19–23 September
13th International Symposium on Medicinal Chemistry. Paris, France.
Administrative Secretariat, Convergences – ISMC '94, 120 avenue

Gambetta, 75020 Paris, France. Fax: +33 (1) 40310165. Telex: 216911F.

Molecular mobility and order in polymer systems

3–6 October.
International Symposium on Molecular Mobility and Order in Polymer Systems. St. Petersburg, Russia.
Prof. A. A. Darinskii, Institute of Macromolecular Compounds, Russian Academy of Sciences, Bolshoy pr. 31, St. Petersburg, 199004 Russia.

Functional & high performance polymers

14–16 November 1994
International Symposium on Functional & High Performance Polymers. Taipei, Taiwan, China.
IUPAC International Polymer Symposium, Taipei (IPST) Secretariat, Prof. Ging-Ho Hsiue, Department of Chemical Engineering, National Tsing Hue University, Hsinchu, Taiwan 300, China. Fax: +886 (35) 726825. E-mail: ipst@nthu.edu.tw

Organic synthesis

11–16 December
10th International Conference on Organic Synthesis. Bangalore, India.
Prof. G. S. R. Subba Rao, (Secretary, ICOS-10), Department of Organic Chemistry, Indian Institute of Science, Bangalore 560 012, India.
1995

Analytical chemistry

9–15 July
SAC 95: International Conference on Analytical Chemistry. Hull, UK.
Prof. A. Townshend, School of Chemistry, University of Hull, Hull HU6 7RX, UK. Tel: +44 (482) 465027. Fax: +44 (482) 466410.

Toxicology and clinical chemistry of metals

10–13 July
5th COMTOX Symposium on Toxicology and Clinical Chemistry of Metals. Vancouver, BC, Canada.
Prof. F. W. Sunderman, Jr., Departments of Laboratory Medicine and Pharmacology, University of Connecticut Medical School, Post Office Box 1292, Farmington, Connecticut 06034-1292, USA. Tel: +1 (203) 792328. Fax: +1 (203) 6792154.

High swelling gels

10–14 July
36th Microsymposium on Macromolecules – High Swelling Gels. Prague, Czech Republic.
Prof. B. Valter, Institute of Macromolecular Chemistry, Academy of Sciences of the Czech Republic, Heyrovského nám 2, 162 06 Prague 6-Petriny, Czech Republic. Tel: +42 (2) 360317. Fax: +42 (2) 367981.

Organometallic chemistry directed toward organic synthesis

6–10 August
8th IUPAC Symposium on Organometallic Chemistry directed toward Organic Synthesis (OMCOS-8). Santa Barbara, California, USA.
Prof. B. H. Lipshutz, Department of Chemistry, University of California, Santa Barbara, California 93106-9510, USA.

35th IUPAC Congress

14–19 August
35th IUPAC Congress. Istanbul, Turkey.
Prof. Yüksel Inel, Chemistry Department, Bogaziç University, P.K.2 Bebek 80815, Istanbul, Turkey. Tel: +90 (1) 2631500 or 2631540, ext. 1619 (direct) or ext. 1610 (secretary). Fax: +90 (1) 2659778 or 2656357. E-mail: INEL@TRBOUN

Industry – education initiatives in chemistry

28 August – 2 September
International Symposium on Industry – Education Initiatives in Chemistry. York, UK.
Prof. D. J. Waddington, Department of Chemistry, University of York, Heslington, York, YO1 5DD, UK.

Ionic polymerization

4–8 September
1st International Symposium on Ionic Polymerization. Istanbul, Turkey.
Prof. Y. Yagci, Fen-Edebiyat Fakültesi, Kimya Bölümü, Istanbul, Teknik Üniversitesi, Maslak, TR-80626 Istanbul, Turkey. Tel: +90 (212) 2852413. Fax: +90 (212) 2856386. E-mail:
Feyusuf@TRITU.bitnet.
Feonen@TRITU.bitn/et

1996

Physical organic chemistry

25–29 August
13th International Conference on Physical Organic Chemistry. Seoul, Republic of Korea.
Prof. J. Suh, Department of Chemistry, Seoul National University, Seoul 151-742, Republic of Korea. Tel: +82 (2) 8805456. Fax: +82 (2) 8891568.

Chemistry of natural products

September
20th IUPAC Symposium on the Chemistry of Natural Products. Chicago, USA.
Dr. R. J. Pariza, Manager, D-54P, Building A-1, Abbott Laboratories, North Chicago, IL 60064-4000, USA.

How to apply for IUPAC sponsorship

To apply for IUPAC sponsorship, conference organizers should write to the IUPAC Secretariat (see inside back cover for address) requesting an Advanced Information Questionnaire (AIQ). Completed AIQs should be returned to the Secretariat preferably 2 YEARS and at least 12 months before the conference. Late applications will not be considered. Further information on granting of IUPAC sponsorship was published in *Chem. Intl.* **14**, 203 (1992).

International Union of Pure and Applied Chemistry (IUPAC)

IUPAC

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The International Union of Pure and Applied Chemistry (IUPAC), formed in 1919, is a voluntary non-governmental, non-profit association of organizations, each of which represents the chemists of a member country.

Its objectives are:

- to promote continuing co-operation among the chemists of the member countries;
- to study topics of international importance to pure and applied chemistry which need regulation, standardization, or codification;
- to co-operate with other international organizations which deal with topics of a chemical nature;
- to contribute to the advancement of pure and applied chemistry in all its aspects.

The membership of IUPAC presently comprises 40 countries, each represented by a national organization, such as an academy of science or research council.

National Adhering Organizations

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Royal Society **(United Kingdom)**
National Research Council, National Academy of Sciences **(USA)**

Chemistry International

IUPAC

1994, Vol. 16. No. 4 (July)

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0193-6484(199407)16:4;1-7

Printed in England by Bocardo Press

ISSN 0193-6484

Chemistry International

The news magazine of the International Union of Pure and Applied Chemistry (IUPAC)

SORTIE
IUPAC 75th ANNIVERSARY
26 MAY 1994 BRUSSELS

IUPAC

1994, Vol. 16. No. 5 (September)

Blackwell Scientific Publications

Chemistry International

The news magazine of the International Union of Pure and Applied Chemistry (IUPAC)

ACTING EDITOR: Michael Ward
SECRETARIAL ASSISTANTS: Mary Patterson and Katie Smith
PRODUCTION EDITOR: Martin Clutterbuck

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Front cover: Professor Zamaraev welcomes delegates to the 75th Anniversary celebration in Brussels.

International Union of Pure and Applied Chemistry

Chemistry for Life – 75th anniversary of IUPAC

IUPAC was founded in 1919 and is now celebrating its 75th anniversary with regional and national symposia on the theme 'Chemistry for Life'. To mark the milestone at the European level, the European Chemical Industry Council (CEFIC) and the Union's Committee on Chemistry and Industry (COCI) held a celebratory symposium at the Royal Academies in Brussels on Thursday 26 May, 1994. Top academics, industrialists and politicians gathered to highlight the contribution chemistry will continue to make in the improvement of quality of life. Mike Ward reports.

Science and technology are clearly the foundations of past and future prosperity in Europe. And this has been recognized at the highest levels within the European Union. In his White Paper on 'Growth, Competitiveness, Employment: The Challenges and Ways Forward into the 21st Century', European Union President Jacques Delors notes that Europe's future prosperity will rest increasingly upon the ability of its people to understand and apply science and technology to create new products and new processes which can be commercially developed across the globe.

Science, however, now requires less specialization and a more multi-disciplinary approach. Prosperity will rely on the ability to understand and apply knowledge of all branches of science – particularly chemistry and chemical engineering – rather than in our ability to make things with ever-increasing manual productivity. To achieve these objectives, however, requires the support of a strong academic base, industries capable of commercializing advances that contribute to improved quality of human life, and, probably most important, politicians creating the right kind of environments that will nurture scientific pursuits from laboratory bench through into the marketplace.

In spite of past successes, and the encouraging noises coming from the European Commission, there is a danger that European science and technology could be left behind. The existence of a thriving academic base, able to generate new knowledge and train future generations of scientists and engineers, is clearly of immense importance to the future success of Europe. Yet the level of science education in the public at large is currently inadequate to generate a society where innovation is eagerly welcomed and promoted. A society on the defensive, obsessed with environmental quality and vulnerable to prophesies of imminent global destruction will struggle to prosper in the next century.

European prosperity has, in the past, been driven by world competitive technology-based industry. Indeed, the European chemical industry leads the world – eight of the world's ten largest chemical companies are European-based and Europe enjoys a trade surplus in chemicals with the rest of the world. Nevertheless, today the European chemical industry is struggling to survive in restricted world markets, whilst carrying a heavy burden of social and regulatory costs. Many industrialists believe present national and European government policies will condemn the chemical industry to a permanent state of competitive mediocrity.

26 MAY 1994 BRUSSELS

Scenes from Brussels:
the Town Hall;
the Grote Market;
St-Hubertusgalerij;

European Industry Commissioner Martin Bangemann details industry policy

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IUPAC 75th ANNIVERSARY
26 MAY 1994 BRUSSELS

Nobel laureate George Porter throws light on photosynthesis

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Cefic President Jacques Puechal congratulates IUPAC on its 75th Anniversary

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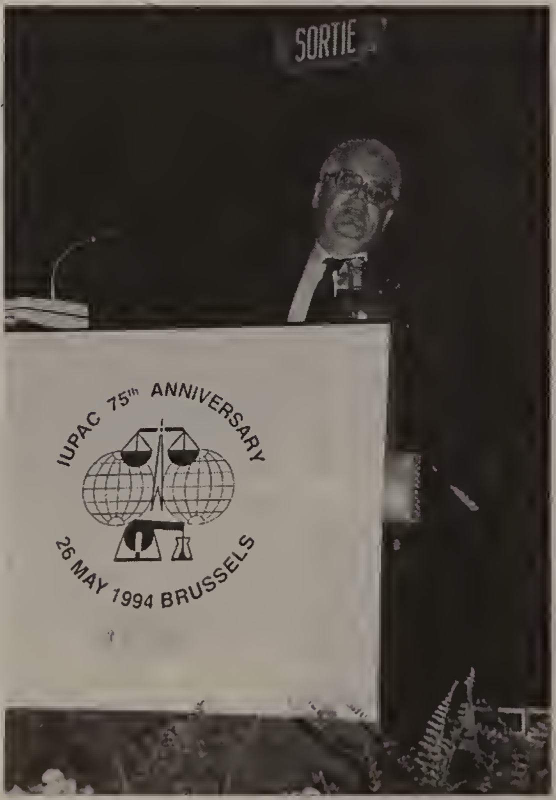
Nobel laureate Jean-Marie Lehn identifies 25 century science

IUPAC President Kirill Zamaraev tells the forum how IUPAC breaks down national barriers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Solvay President Baron Daniel Janssen explains the need for training

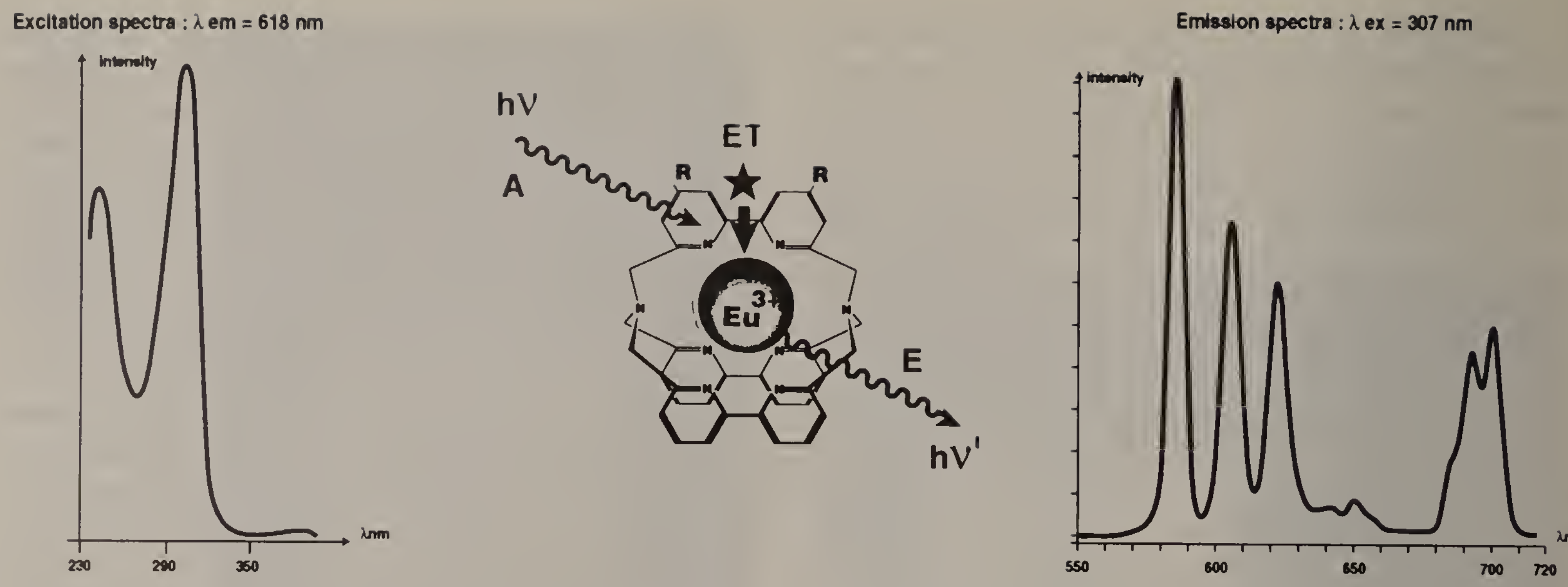
It was in this context that CEFIC and COCI invited Nobel laureates, leading industrialists and government officials to explore the opportunities offered by chemistry. The meeting was co-hosted and co-chaired by Jacques Puechal, President of CEFIC, and president and chief executive officer of Elf-Atochem, and IUPAC president Kirill I. Zamaraev. In the afternoon, which was chaired by IUPAC vice-president Albert Fischli, delegates listened to presentations of new science by leading European scientists.

IUPAC crosses national boundaries

Chemists have a difficult job on their hands, according to IUPAC president Kirill Zamaraev, not only do they have to be continuously innovative, they will also have to ensure the public understands and knows how to apply new technologies appropriately. It is to meet this challenge that CEFIC and the Union decided to collaborate with the forum. 'Chemistry is certainly one of the most important areas from where new knowledge and new technologies are emerging. The chemical industry plays a key role in its implementation so it is of critical importance that they approach the public so that people understand better chemistry and chemical technologies. To show that chemistry will help improve the quality of their lives without sacrificing their long term safety and quality of the environment,' Zamaraev told forum delegates.

Indeed, Zamaraev noted, chemistry should be seen as part of the solution and not the problem. He reminded delegates that chemistry will provide better health, more food, minimal consumption of exhaustible fossil fuels and raw materials, and newer sources of renewable raw materials and energy. 'Elimination of acid rain, decreasing pollution associated with, and adding to, the greenhouse effect, protection of the ozone layer. This is just a short list of those challenges which can be met through applied chemistry. And there are more technologies to emerge in the coming years.' But the rational implementation of these new technologies on a European or even global scale in the next century will only be possible through the co-ordinated actions of governments, legislators, top industrialists, engineers and scientists, Zamaraev warned. 'We have to work together as an interprofessional and international team if we are to succeed.'

The Atomium in Brussels.



The rare earth cyptates are formed by the inclusion of a luminescent lanthanide ion in the cavity of a macropolycyclic ligand containing 2,2′-bipyridine groups as light absorbers.

IUPAC may provide that recipe for success. Zamaraev believes that the major stakeholders in chemistry's future may be able to learn something from IUPAC's history and approach to organizing its work. 'It is a non-governmental, non-profit organization. There are 45 member countries, although some other countries have joined the Union as observers, there are also 30 organizations associated with the Union. About 1200 experts from governments, industry and academia work on a voluntary basis for various commissions and committees of the Union. IUPAC has a world-wide affiliate membership scheme of more than 7000 chemists – including about 600 from 30 developing countries.'

The Union's links with industry – more than 160 chemical companies from 25 countries have joined the IUPAC company associate scheme – and other international organizations such as UN agencies place it in a unique position to help promote chemistry and its image. Zamaraev noted the joint IUPAC/UNESCO/UNIDO training programme for the safety and environmental protection in chemical, pharmaceutical and biotechnological production. This programme helps safety experts from developing countries learn about the safety and environmental protection methods/measures by visiting plants of IUPAC company associates in the industrialized world. The next issue of *Chemistry International* will look at this programme in more detail.

Working on topics of international importance to chemistry which need some regulation, standardization or quantification, IUPAC's contribution to the creation of consistent nomenclature rules in various areas of chemistry – the development of the language of chemistry – is particularly appreciated by the world chemical community. For Zamaraev, the remarkable vitality and robustness is evident by the fact that it survived the second world war and was able to keep open channels of communication through the iron curtain while the rest of the world was gripped by the chill of the cold war. 'Whatever the political situation, IUPAC would always bestow a warm welcome at its meetings for chemists from every country whether the USA or USSR, Egypt or Israel, Ethiopia or the Republic of South Africa.'

IUPAC, Zamaraev added, has shown that chemistry does not recognize national borders and that chemists, scientists and engineers can work together in international multidisciplinary teams for the betterment of mankind. There is hope that this co-operative approach will catch on elsewhere. 'We are now seeing governments and legislators, here in Europe, starting to work together as teams in the best interests of people. For this to truly succeed there needs to be a partnership of governments and legislators with the decision makers in industry, and engineers and scientists. Needless to say, IUPAC is most willing to participate in the efforts to improve through science and new technologies the quality of life in Europe and the World, by providing the skills of its voluntary experts in chemistry throughout the world, as well as the international network.'

Science of the 25th century

Nobel laureate, Jean-Marie Lehn is not concerned when colleagues from other scientific disciplines describe chemistry as the science of the 19th century, physics the science of this century, and biology the science of the 21st century. That is because he believes chemistry is the science of the 25th century. 'That does not mean to say we are primitive or prehistoric. Its just that biology shows us how complex chemistry can be and what it might be possible to achieve.'

Chemists have in past years developed an enormous number of methods to produce molecules from atoms – so-called molecular chemistry. In this way, chemists have been able to manufacture new molecules with desirable properties, a process that underpins one of Europe's most important industries. The chemical industry is a vital supplier of materials for other industries and Lehn believes it is the responsibility of the heads of chemical companies to ensure a steady stream of new and innovative molecules.

According to Lehn, chemical companies will have to look beyond the molecular chemistry associated with covalent bonding to increase their synthetic power. 'Rather than focusing on covalent bonds it is possible to concentrate on the weaker forces that exist between molecules; non-covalent interactions that build another branch of chemistry – supramolecular chemistry.' This is a chemistry that goes beyond the molecule. A chemistry that already plays a major role in life as many non-covalent interactions are crucial to the way many biological molecules stick together or recognize each other.

Lehn is convinced that biology will provide the inspiration for future advances in supramolecular chemistry. A key component of biochemistry is the concept of molecular recognition – the process which allows a killer cell to recognize only tumour cells and not healthy ones, or a virus to recognize the cell it intends to attack, or an enzyme to recognize its substrate. Interference with such recognition processes are increasingly important in the development of therapeutics. Lehn reminded the forum audience that molecular recognition came into its own exactly 100 years ago when Emile Fischer postulated that for molecules to recognize each other they must fit like a lock and key.

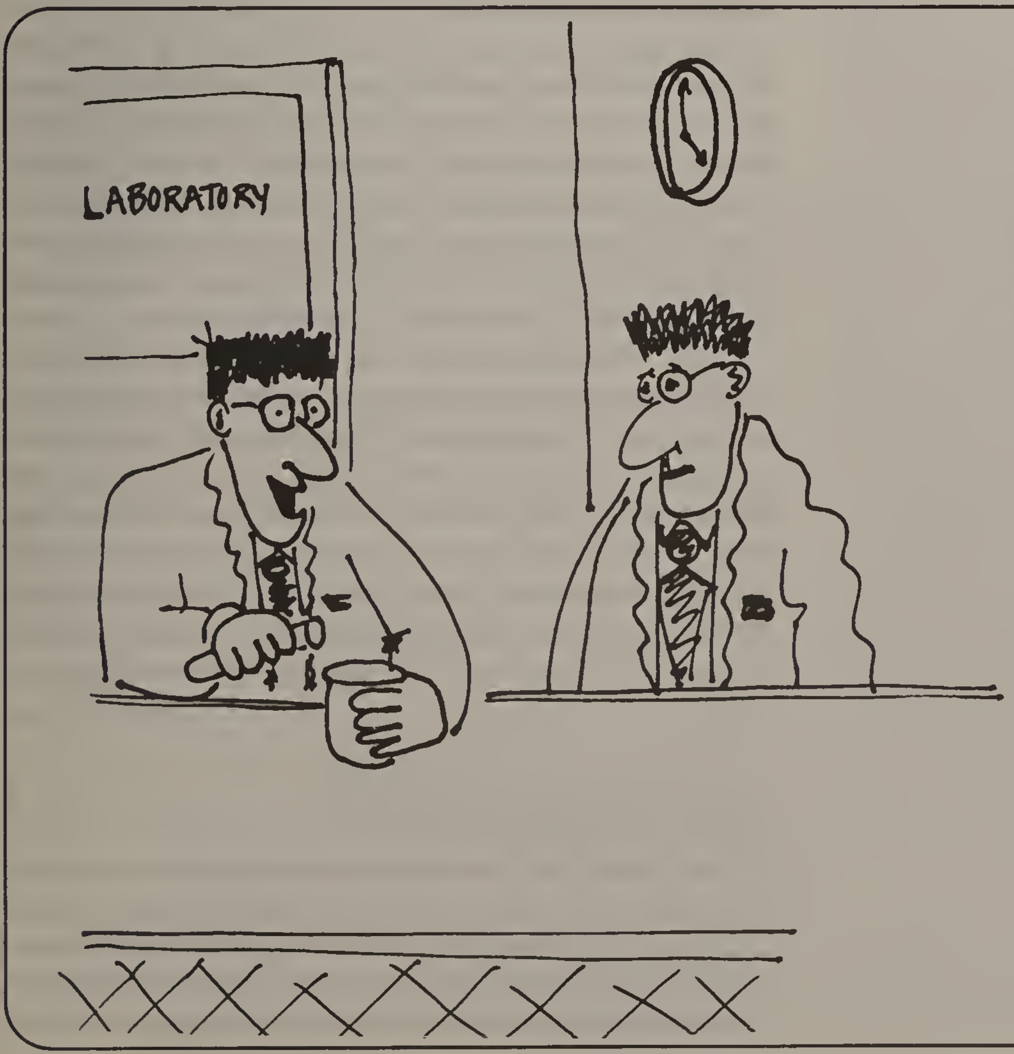
This fitting together of the lock and key is the basis of some very selective chemistry; chemistry that spans organic chemistry, inorganic chemistry, biochemistry and pharmaceutical development. Indeed, many pharmaceutical companies are developing therapeutics on a rational basis by designing molecular keys that fit the receptor lock more efficiently than the natural molecules. The most important example of selective chemistry is that associated with the genetic code. Nucleic acid polymers carry the information that, as Lehn amusingly noted, ensures that we are not cats and dogs. Recognition and deciphering of the genetic code ensures that all the right messages required for an organism to function are preserved and read as correctly as possible.

Molecular recognition can provide the basis of device development. A series of ions, for example, can be distinguished by their diameter. This is the basis of the interaction of potassium and sodium ions with cell membranes and the transmission of nerve impulses. This principle, Lehn postulated, could be used to develop monitoring devices. 'A device could be developed involving a chemical system which has components acting on different carriers such as electrons, protons or ions and handling them, selecting them, holding them, transporting them, releasing them, and using them to generate signals.'

Lehn told the audience that a device based on the principle of signal chemistry has indeed been developed. French researchers have developed a new method for immunoanalysis based on rare earth cryptates. A light harvesting molecule has been built, in which a europium ion is encased. The outside molecule absorbs ultraviolet light and the energy is transferred to the internal europium ion, which responds by emitting red light. Lehn revealed that medical diagnostic devices can be made based on this compound; diagnostics that allow for rapid evaluation, are easily adapted for automation, and can provide high intra- and interassay precision as there are none of the separation-washing steps associated with other assay methods.

Research is currently taking place which could lead to the development of molecular electronics. Scientists are trying to make wire at the level of the molecule with a view to using molecules as computer components. Progress is still very much at the fundamental level and so potential application is still some way off, although Lehn is convinced that it will be achievable. 'In the future, it will be possible to have systems that perform at a very small scale, operations which are usually needing larger set ups.

One of the most fascinating properties, for Lehn, that some biological molecules possess is the ability for self assembly. In conventional chemistry, the chemist usually will dream up



'This molecule is so smart, not only does it assemble itself, but it writes up the paper and then submits it for publication!'

the chemical, draw it and then build it from scratch. The challenge is to possibly use components which already know what end product they should form. 'If we look at the Notre Dame cathedral just think how it would be if each stone had an inscription telling what to do so that it can build itself.'

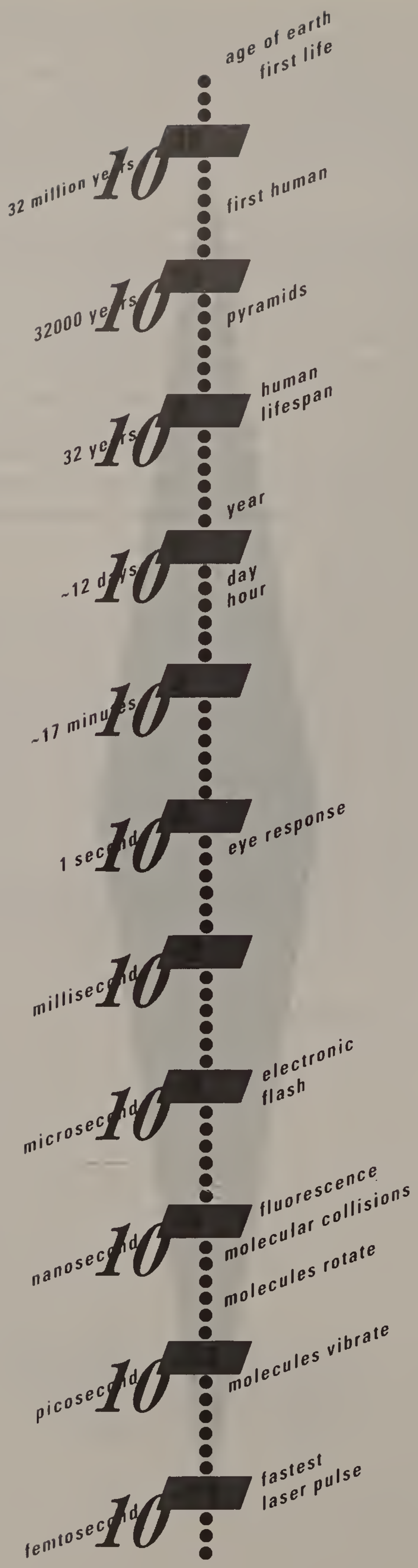
Although this notion may sound fanciful, this, Lehn reminded delegates, is precisely what the tobacco mosaic virus is able to do. 'The tobacco mosaic virus builds continuously 2200 particles that then assemble themselves to provide the virus coat protein. In other words, these peptides contain all the information and instructions needed to create the architecture. The particles have to recognise each other and know when to start assembling and know when to stop. The stop building signal is carried in the genetic code of the virus.'

Another well-known self assembling molecule is the double helix of DNA. Lehn showed the audience that his laboratory has managed to make double helical molecules that wrap around each other and that by changing the metal ions associated with them it is possible to form triple helices. Similarly, Lehn has created chemical structures similar to complex self assembling enzymes. Many enzymes are complicated structures involving different proteins that come together and know precisely where they should go, how they fit together and what their function is. Building chemical mimics, however, is like building skyscrapers from houses, Lehn noted.

When Lehn looks at these biological role models, he is not just looking at their intricate architecture and construction capabilities, he is also looking at how they operate as information systems. 'This is leading to the development of a new paradigm. We are shifting from mechanical chemistry to information chemistry asking the question not only what is the structure of the molecule? but what is the information contained within? This changing outlook is a very important one for the future in it has important implications for the way we look at chemical systems.'

Clearly, chemists are now having to look at what conventional chemical and biological systems now offer and how this can direct research. Biological systems are clearly very complex but are actually quite limited in their diversity. 'Biology shows us how complex chemistry can be. You could not imagine some biological molecules they are so complex. If we did not exist we could not imagine ourselves because we are so complicated. But we do and therefore it works.'

On the other hand, Lehn contends, chemistry allows many combinations based on Mendeleev's table of elements, providing they follow the laws of chemistry, but the results are very simple when compared with biological systems. 'The challenge is to get somewhere between; a challenge that chemistry will meet.' Indeed, Lehn believes that chemistry is such a creative power that it will make worlds that do not currently exist. 'It is clear that there is a lot of interesting work for our grandchildren and their grandchildren to do,' he concluded.



The time scale of photomolecular events. Time ladder from man's lifetime to femtoseconds with main molecular events included.

Chemistry under the sun

Picking up on Zamaraev's observation that chemistry recognises no national boundaries, Lord George Porter, a Nobel laureate and practising photochemist, added that science is the most international of human activities. 'Whilst international union, in matters like defence and fiscal policy, is still struggling to be born, scientists themselves have, since the renaissance, been oblivious to national frontiers.

Science for life, according to Porter can be interpreted in several ways. One meaning, which Porter feels an affinity to, is the dedication which many scientists feel to a life in science. 'Many, like me, started having fun with chemistry before they were ten and now at ten and threescore years – and then some – are as fascinated as ever. We have not yet discovered how to make gold but, in contentment and satisfaction with our lot, we are the richest people on earth.'

The other interpretation, which supports much of what Lehn was proposing, is the scientific understanding of life itself – its structures and processes at the material and, especially to chemists, at the molecular level. For Porter, probably the most important biochemical event is the photochemical reactions associated with photosynthesis. 'Without that light on the first day the rest could not have happened. there would be no food, no fuel, no organic chemicals, no life us.'

Indeed, while the tobacco mosaic virus, referred to by Lehn, is busily involved in the process of self-assembly, the rest of the universe is running down, heading towards chaos, increasing in entropy. '[The self-assembly] is only possible because of the free energy that has been built up in the proteins which is then dissipated as assembly takes place.' Although the process of photosynthesis has been around for at least two thirds of the age of the Earth, the study of the rapid changes that take place within and between molecules has been restricted to the past 40 years. Although the rate of understanding what is actually happening at the site of photosynthesis in the plant leaf is, according to Porter, increasing daily.

Until recently all the information relating to the primary processes of photosynthesis has been obtained from relatively simple, though still very complex, photosynthetic bacteria in which the absorption of light brings about a transport of electrons through a chain of some five molecules spanning the membrane. In plants, the process is more complex. It happens in the leaves in organelles called chloroplasts. Electron micrographs show that chloroplasts are made up of lipid membranes which contain proteins that do the work.

There are two important photosynthetic sites, dubbed photosystem I and photosystem II, which work in series. Photosystem I is responsible for reducing carbon dioxide to glucose, while photosystem II contains several manganese atoms with the oxidizing potential to change water to oxygen. Until recently, work on these photosynthetic molecules has been very difficult because their complexity means that it is impossible to obtain three dimensional crystals for X-ray crystallography. Using electron crystallography, which requires only two dimensional crystals, Andy Kühlbrandt and his colleagues at EMBO in Germany has managed to get 0.35 nm resolution pictures of the light harvesting complex, revealed to the forum.

The job of the light harvesting complex is to collect the energy. It consists of three almost identical parts each containing 12 chlorophyll molecules, 5 b molecules on the outside, 7 a molecules on the inside with alpha helical proteins holding the whole lot together. Electrons have to travel along these molecules but no two molecules must touch each other in the wrong orientation otherwise the energies are quenched. The average distance between the centres of chlorophyll molecules is between 0.9 nm and 1.4 nm.

Forum delegates in informal discussions.

Porter is most interested in the kinetics of photosynthesis. Reactions that take place at breathtaking speed. The range of time associated with photosynthesis is longer than human experience starting some 10^{17} seconds ago; the fastest processes occur just after the sunbeam's energy has been absorbed and occur at about 10^{-15} seconds. At this speed, Porter noted, the Heisenberg's uncertainty principle raises its ugly head, as far as the chemistry and biology are concerned, as nothing can be known about the energy of processes beyond that point.

Using flash photolysis, Porter and his colleagues have been able to measure what is happening around 10^{-14} seconds. The principle of flash photolysis, Porter told delegates, is very simple, but the apparatus is frightfully complicated as it is very difficult to line up because of all the optical components. It works by splitting one pulse of light, one half going to the target while the other is diverted by mirrors so that it hits that target a fraction later. Light travels 0.33 mm in 1 ps, so by moving the mirror that distance it is possible to have pictures of what has happened over the 1 ps.

Porter's group at Imperial College, London, has measured the changes that take place every 7 fs during the energy transfers associated with photosynthesis. By looking at the differences between plant and bacterial photosynthesis it is possible to attribute changes in speed to subtle changes in the amino acid composition of the proteins. Consequently, the stage is approaching when the mechanism of the green engines of photosynthesis, their structure and their genetic basis will be fully known and understood.

In the first green revolution, Porter noted, chemists met the demands of the King of Brobdingnag in Gulliver's travels, and 'made two ears of corn or two blades of grass grow where only one grew before.' Unfortunately, they have yet to receive the acclaim the King forecast because he thought that 'those who brought it about would deserve better of mankind and do a more essential service for the country than a whole race of politicians put together.'

Armed with knowledge about the mechanics of photosynthesis chemists will drive the second revolution which is almost here. Porter is confident that scientists will soon be able to design photosynthesis, and steer evolution itself, so that it makes the products consumers want, economically and with a minimum need for energy or further processing.

Science education drives industrial success

IUPAC has an important role in helping the chemical industry meet many of the challenges it faces, particularly where science and education hold some of the most important keys, Baron Daniel Janssen, president of the executive committee of Solvay, told forum delegates. Industrial success can only be achieved, he said, if companies are competitive, and education plays an important role in that process.

Janssen highlighted the education challenges, identified by various reports published by the Industrial Research and Development Advisory Committee (IRDAC), companies face. 'We need to develop total competence in people; prepare them for a life of learning; we must adopt quality concepts – well known in the chemical industry – in education and training; we must stimulate a learning culture in our companies: and we must draw the attention of governments to their own responsibilities regarding education.'

Availability of people with the right skills at all levels from the shop floor to the top management has always been an essential requirement for industry. Janssen believes that providing access to education is no longer sufficient, it must be the right kind of education which will teach people the skills that both industry and society requires. And what are these skills? A recent report on Euro Management, the European Roundtable of which Janssen is a member, identified the following essential skills:

- the capacity to change;
- an open mindset;
- the ability to learn from others;
- an entrepreneurial spirit;
- communications skills, including languages.

'For the educational system to provide those skills, pupils and students must benefit from better-balanced curricula in schools and higher education. Initial education is essential. It must resist the temptation of too narrow and too premature specialization but rather provide multi-disciplinarity and professionalism.' Indeed, the seeds encouraging people to want to continue education throughout their lives and embrace the concepts of total quality are sewn at an early age.

Higher education needs to meet some challenges. In order to grow and maintain a competitive edge, industry needs universities to turn out graduates that are able to turn ideas into practical commercial propositions. Janssen noted that in Spain, France, Germany, the UK and the Republic of Ireland, increased attention is being given to initial vocation education and that others should follow their example.

Industry, however, should not expect governments to take all the responsibility for educational programmes. Janssen believes industry has a major role to play in partnership. 'We must also bring our active contribution to this partnership: we must develop a learning culture within our companies, encourage and reward our personnel who actively get involved in permanent education.' Larger companies also have a duty to help out small and medium-sized enterprises to gain access to education, training and R&D, through training courses, for example.

HEIDELBERG APPEAL (Excerpt)

'The greatest evils which stalk our Earth are ignorance and oppression and not Science, Technology and Industry, whose instruments, when adequately managed, are indispensable tools of a future shaped by Humanity, by itself and for itself, overcoming major problems like overpopulation, starvation and worldwide diseases.'

SOLVAY

Interest in educational programmes by industry is not focused just on ensuring future qualified work forces. Companies have identified the importance a partnership between educators and industry is in the promotion of science and its achievements to the general public. Earlier this summer, CEFIC launched an ambitious five-year programme of education-industry actions called 'Chemical Industry and the Young Mind', working hand in hand with the European teachers associations such as ICASE and the Society of Chemical Industry.

Janssen reminded the audience that the chemical industry has been the target of many campaigns, particularly some criticizing the sector's environmental performance. While some campaigns may be justifiable, Janssen noted that others picture the industry only as a source of risks and no benefits. 'A greater level of scientific literacy would equip people to be better judges of the great options which form part of the environmental debate.'

Innovation drives success

Mankind has a lot to thank chemistry for, according to Hans-Jürgen Quadbeck-Seeger, BASF AG board member and president of Gesellschaft Deutscher Chemiker. 'As long as man had to rely on products offered him by nature, he was capable of only very limited reaction to threats such as scarcity of food or epidemics. It was only the use of chemical methods that made it possible to synthesize products which nature supplied inadequately, if at all; products such as fertilizers or effective drugs.'

Quadbeck-Seeger described the various theories associated with innovation including the Schumpterian notion that innovation is indeed one of the most important drivers behind a national economy, alongside the traditional factors of capital and labour. The balance of technology-push/market-pull as drivers of innovation seems to be changing. Quadbeck-Seeger noted that from the start of the industrial revolution until mid-way through this century there was virtually no limit to the adsorption capacity of markets, and development was largely determined by the availability of products and technologies.

'A change set in during the 1960s: increasingly, the market became the dominant force behind product technology and development. markets became more differentiated and more fastidious. In connection with the development of chemical products for the end consumer, technology push is now named as the driving force in less than 40% of cases,' he informed the forum. But this market demand is evolving; it no longer confines itself to actual needs it is now embracing societal demands. Chemical companies are now finding the public's awareness of environmental issues is forcing innovation.

'The development of environmental awareness among the population has, in virtually all industrialized countries, found expression in a proliferation of regulations. For example, flue gas desulphurization and denitrification unit have been imposed, as have catalytic converters for automobiles. In all these cases, the technology required to produce this equipment was not initially available. There was no technology push, in other words. Nor was there any specific demand for this equipment from private consumers. It was a case of markets being created by governments. Markets which are not ruled by the traditional pattern of supply and demand.'

Nevertheless, scientific achievements, rather than sociological demands, have tended to provide the starting points for innovation. 'The stepping stone in the transition from hermeneutic alchemy to modern scientific chemistry is Lavoisier's theory of oxidation based on the uptake of oxygen during combustion. Kekulé's benzene theory of 1865, Bohr's atomic model of 1913, the 1927 models for the description of chemical bonding and the 1970 theory of the self-organization of matter are milestones in theoretical chemistry which have had profound effects on chemistry as a whole.'

Innovation is a process that cannot stand still and society needs technological progress. Developments which shape the future, such as population growth or depletion of resources, have an intrinsic dynamism. 'If we suspend our efforts, we move backwards. We need to innovate. But innovations require an ethical component, reflecting the needs of the future.' This growing ethical component in the innovation cycle is also having to be embraced by the chemical industry. The emphasis companies are now putting into corporate and environmental guidelines bears witness to the impact ethics are now having on business practice.

Quadbeck-Seeger, however, cautions restraint. While agreeing that it is no longer valid to have blind faith in progress, 'blind and deaf hostility to it is even less desirable. What we have to aim at is constructive creativity, developed jointly and rooted in reality. This is different from the present efforts of those responsible for environment policy, for example, in Germany, to play a pioneering role at almost any price with no certainty that their lead will be followed.'

Nevertheless, he is optimistic that scientists will be able to keep progress under control. His confidence is based on three factors:

1 better understanding of biological processes and ecological systems is laying the foundation for better, more specific solutions to problems;

2 scientists are taking greater responsibility for their discoveries and inventions;

3 technological progress always provides the means for self-monitoring.

WONDERS OF SCIENCE
WONDERS OF SCIENCE
The sustainable cycle of salt ...
7%
93%
0.4%

One of the poster presentations.

'The hole in the ozone layer, for example, was discovered not at press conferences or political meetings but by scientists using ultrasensitive measuring equipment and sophisticated measurement techniques.' However, such technological progress can have its downside as Quadbeck-Seeger noted. The unbelievable degrees of accuracy of analytical detection which allows detection of virtually anything in everything, instead of being welcomed as a gain in knowledge and safety, are usually perceived as a growing threat. 'Politicians then often succumb to the temptation of defining what is just measurable as the new permitted threshold.'

Quadbeck-Seeger called for politicians to introduce only those laws and regulations that have a sound scientific basis. Caution needs to be selective and justifiable and not based on assumptions and suspicions. sustainable development is a worthy goal but it is important that the sustainable element is not emphasised at the expense of development. 'There is no sustainability without development, and an essential aspect of it is, of course, the development of science, ' he warned.

Creating the right environment

Contrary to the perception of many in industry, not all European Commission officials are intent on making life hard for the chemical business. European Commissioner Dr Martin Bangemann, described by Puechal as a strong advocate of European industrial policy, is also a great admirer of the chemical industry. He noted that in Europe it employs 1.8 million highly qualified people, enjoys a massive trade surplus with the rest of the world, consists of the world's leading players, is a major supplier to other industries, and its products are the basis for their competitiveness as well. As a politician, he said, he dare not ignore such industrial influence.

Yet Bangemann is not blinded by the industry's brilliance. The picture is not without its problems. First, there are growing demands for environmental policies. Bangemann believes that the whole of society should care for the environment and that some environmental legislation is necessary. 'But we need a very logical and rational discussion of these problems – that is lacking not only sometimes but very often.' Bangemann is concerned that there is a growing scepticism for technological progress. This he says is very great threat to the future competitiveness of European industries.

'We are trying to overcome such reluctance – or to help overcome them. The message is clear, if industry is not using the most efficient technologies, and sometimes the most efficient technologies are not those that are best known or totally acceptable to public opinion, it will become uncompetitive.' He cited the public apprehension of biotechnology as one example of a crucial competitive technology that could be hounded out by adverse public opinion. Industries such as pharmaceuticals and chemicals will need biotechnology to ensure their future competitiveness.

Yet this competitiveness may already be ebbing away. Bangemann told delegates that Europe is clearly not as competitive in global markets as it was in the past. He cited the decline in influence of European discoveries in the pharmaceutical sector. From a once dominant position, the percentage of pharmaceutical and biopharmaceutical patents being awarded to European is declining, while the US and Japanese are doing a much better job. About 66% of biotechnology patents go to US firms, 13% to Japanese firms and 15% to European ones. 'We have to do something about this. we have to catch up and improve our competitiveness in this field, because it is one of the fields of the future.'

In a bid to stem this tide, Bangemann and his officials in Directorate General III have promoted an industrial policy. Not an easy task in the European Union as many member states have had bad experiences with national industrial policies which involved state-owned industries or the use of subsidies. For Bangemann there are two types of industrial policy the good ones and the bad ones. He is only interested in the former, he reassured delegates. 'The good one involves not mixing the responsibilities of business and politics.'

Bangemann's approach to industrial policy is to ensure that competitiveness is not undermined nor uncompetitiveness protected. One example of the industrial policy in action was the re-establishment of the marketing monopoly associated with pharmaceutical patents. Pharmaceutical companies had told the Commission that their ability to innovate was being hampered by erosion of effective patent life. The patent protection started when the patent was awarded, but because of the lengthy clinical trials associated with pharmaceutical development, the amount of time left for the patent to run when the drug came to market was very small, making it difficult for companies to recoup their R&D expenditure.

There was a simple answer to the pharmaceutical industry's problems: start the patent clock running when the pharmaceutical gets market authorization. But the simplest solutions are sometimes the most difficult to implement, Bangemann told the forum. 'My officials said to me Oh no, its not possible, and I said why not? and they said we have never done this before and also there are international conventions such as the Berne Convention which does not allow such moves. I said that is OK, we change the Berne Convention as well.'

Interestingly, Bangemann's patents revolution has been applauded by industry and other governments. He believes that industrial policy must embrace internationally acceptable ways of operating so that no one feels disadvantaged. The area of testing, such as the toxicological requirements associated with pharmaceutical and agrochemical authorization, is one potential target for international harmonization. he clearly believes government and industry should work closely to ensure that mutually beneficial objectives can be met.

Finnish start industrial strategy

Finland has recently introduced a national industrial strategy to help it bear up to the competition of the West and the cost challenges of the East by promoting general business conditions but avoiding co-ordinating or subsidizing individual operations, explained Hannu Vornamo, director general of the Chemical industry federation of Finland. Technology innovation is also seen as a crucial driving factor in the country's ability to compete. In the past 12 years, the proportion of GNP invested in R&D has increased from 1.2% to 2.1%, with the target for 1997 being 2.7%; the private sector accounts for more than 60% of Finnish R&D spending.

National technology programmes in the strategic industrial areas, which includes chemicals, are planned in close consultation with industry, research institutes, universities and technology administration, and TEKES, the Technology Development Centre, which is responsible for programme coordination and principal financing. Concerted industrial involvement ensures that the programmes serve the needs of the country's industry. The chemical industry federation of Finland recently defined technology strategies for industry. It believes that in the restructuring of the Finnish higher education system, higher education and research in chemistry should be better focused and co-operation between universities and industry increased.

Key technology areas identified by the chemical federation are:

1 Manufacturing technology, new compounds and materials – focusing on synthesis technology, catalysis technology, enzyme technology, gene technology, fermentation technology;
2 Pharmaceuticals – focusing on pharmaceutical manufacturing, molecular biology, diagnostics;
3 Pulp and paper chemicals – focusing on paper chemicals, carbohydrate chemistry, printing ink technology, packaging technology, pulping and bleaching chemicals and process development;
4 Polymer and resin technology – focusing on polymerization, new processing methods, composite materials, coating materials, biopolymers;
5 Process technology – focusing on separation technology, process control technology, combustion and gasification technology, energy technology, environmental technology.

Chemistry has pivotal role

Clearly, there is a consensus among the participating academics, industrialists and politicians that science, and chemistry in particular, has played a major role in improving living standards. Chemistry still has a great future, indeed, Lehn believes it will be the science of the 25th century, but to meet its full potential all the stakeholders must co-operate, chemists must draw upon the expertise of other scientists, and consumer concerns, wants and demands must be addressed. All these challenges require communication and it is clear, from the warm words said about IUPAC and its efforts, the Union will continue to play a major role in the development of chemistry.

Chemistry for Life' event in Switzerland

CHEMISTRY FESTIVAL 1994 to celebrate the 75th anniversary of IUPAC

Saturday/Sunday, 24–25 September 1994
University of Fribourg, Switzerland

Patron Schweizerisches Komitee fur Chemie, CSC
Sponsor Deutschschweizer Chemiekommission
Commission romande de chimie

To celebrate the 75th anniversary of IUPAC, events are being organized on a global scale around the theme '*CHEMISTRY FOR LIFE*'. The prime aim is to redress today's perception of chemistry – including as a science – by a positive future scenario, a positive perspective of chemistry, and to show that chemistry's contributions will help to solve major problems facing mankind and his environment.

Within this over-all context the Swiss event will be focused on the secondary education sector:

From all Swiss secondary schools pupils interested in chemistry will be invited to a *CHEMISTRY FESTIVAL*.

Centre-point of the festival will be discussions between pupils and specialists from university and industry. Chemistry's role in preserving and improving the quality of life will be dealt with as an integral part f topical issues such as 'health', 'nutrition' and 'environmental protection' in workshops and in a panel discussion with media representatives participating. A special workshop will be devoted to a recent energy generation techniques and computer-assisted chemistry.

Alongside these there will be other activities such as counselling on careers and career prospects in chemistry, and briefings on 'Research projects for young people', Chemistry study week'. and' Chemistry Olympics'.

To mark to two-hundredth anniversary of *Lavoisier's* death the pioneering discoveries in chemistry over the last 200 years will be presented.

The event will close with fascinating experiments and a lecture on 'fire-light-heat-energy'.

H. H. Bosshard

Project Committee: Dr W. Bachmann (Kantonsschule Zürcher Unterland, Bülach), Dr H. H. Bosshard (Project Head), Dr M. Cosandey (Gymnase cantonal de Chamblandes), Prof. Dr F. P. Emmenegger (University of Fribourg), Prof. Dr P. Müller (University of Geneva, Dr D. Wyrsch/Dr H.-L. Senti (IUPAC), M. Ziegler (student, University of Fribourg).

Environmental problems in the Federal Republic of Germany

Karl Heinz Eickel and Peter Warneck*

This is the fourth in a series of articles on regional environmental problems prepared by members of the IUPAC Commission on Atmospheric Chemistry

Introduction

The unification of Germany in October 1990 has made it necessary to reconsider the question of environmental challenges for the country as a whole. Environmental policies in the two German states prior to their union were quite different. In the western part of the nation, that is the old Federal Republic of Germany (FRG), environmental issues were debated in public, a concerted effort was made to reduce emissions of pollutants to the atmosphere by suitable control measures, and for this purpose emission inventories were established for the most important pollutants. In the eastern part of the country – the former German Democratic Republic (GDR) – air pollution was largely tolerated and environmental problems were often concealed for fear that control measures might hamper industrial productivity. Moreover, data on air quality and other information on the environment were declared confidential by the state authorities, so that even scientific institutions were sometimes unable to complete work begun to assess the environmental situation.

A reliable survey of environmental problems in the former GDR is still not possible for a variety of reasons. Although environmentally relevant data were collected at many places, often in detail, after the disclosure of formerly restricted information, these data were, to some extent, distorted for political reasons, and were partly misleading because control measurements were not done. In addition, the methods of data collection and classification differed from those used in west Germany so that a comparison of data from both parts of the country is difficult.

In the western part of Germany the most burning environmental issue during the preceding decade was, and still is, the forest die-back. Although this phenomenon is also rampant in east Germany, it has not been given much attention there for the same reasons that other environmental problems have been ignored.

Problems of air pollution in the former GDR

Much of the air pollution in eastern Germany is caused by the widespread use of sulphur-rich lignite for energy production and home heating. This is compounded by old industrial units, insufficient stack heights for the dispersal of effluents, and a lack of modern control equipment for pollutant emissions. Energy consumption in this region is 233 GJ per capita, the third

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The impact of automobiles on atmospheric pollution is increasing

highest in the world after Canada and the USA. The rather inefficient and environmentally detrimental energy supply system generates 83% of electric energy from the combustion of lignite. In 1989 the mining and consumption of 320 million metric tons of lignite with a sulphur content of 0.6–3.5% led to sulphur dioxide emissions of the order of 5.2 million tons. In comparison, western Germany emitted 1.05 million tons during the same year. The average burden of SO_2 in east Germany – an area of 103.3 km² with a population of 16.7 million – was 48 ton/km² or 313 kg per capita. The average annual per capita emission of SO_2 in most west European countries amounts to less than 100 kg; in the old Federal Republic of Germany the value was only 17.5 kg in 1989.

A similar situation exists with dust emissions, which in 1989 amounted to 2.1 million tons in eastern Germany. This gives an average of 19.4 tons/km² or 126 kg per capita – much higher than other European countries. However, nitrogen oxides emissions only amounted to 600 000 tons in 1989, or about one fifth of that in the former Federal Republic. A major reason for the lower NO_x emission rate is probably the lower temperature used in combustion processes. This applies to lignite combustion as well as to the two-stroke engine cars manufactured in the former GDR. Additional factors undoubtedly include the smaller number of automobiles per capita and their lower average speed on the road.

The high rates of pollutant emissions have led to considerable ariel concentrations. According to a report on the environment of the GDR published in 1990, six million citizens were living in areas with SO_2 concentrations perpetually exceeding the maximum allowable values which are 0.5 mg/m³ for 30 minutes or 0.15 mg/m³ long term (FRG standards). The maximum allowable concentrations for dust of 0.5 mg/m³ (short-term) and 0.15 mg/m³ (long term) were breached in regions inhabited by 4.3 million people. The highest SO_2 concentrations occurred in the southern, highly industrialised region of the former GDR where annually averaged values of between 0.16 and 0.38 mg/m³ were found. In comparison, in the Ruhr valley, a region of western Germany with a comparable degree of industrialization and population density, the average SO_2 concentration in 1988 was only 25–35 µg/m³.

Although these high emission rates frequently led to smog episodes in east Germany they were not officially recorded until 1989 when a new regulation made it mandatory to inform the public via the local press and radio stations about the severity of the incident and its possible consequences. Further problems are local emissions of pollutants such as lead, cadmium, hydrogen sulphide, hydrogen chloride and toxic organic compounds due to the clustering of chemical production in certain areas.

Special problems of air pollution in the region of the former Federal Republic of Germany

FRG has achieved a leading position world-wide in air pollution control. Urged by well-directed environmental federal policy, the most important emitter groups – the energy producers, industries and home owners – have done much to reduce the emission of air pollutants within their domain of responsibility. A prime example is the reduction of sulphur dioxide emission from about 3 million tons in 1982 to 1.05 million tons in 1989.

Currently the greatest cause for concern is the continuous rise in the number of automobiles, now numbering 30 million, which has led to a corresponding increase in the annual emission of nitrogen oxides from this source. The rate of nitrogen oxide emission in 1978 was about 3 million tons in total with 1.34 millions tons, i.e. 45%, caused by mobile sources. The rate of nitrogen emission in 1987 was 2.9 million tons, but the contribution from automobile traffic had by then increased to 62%. Evidently, the growth in the number of cars on the road had cancelled out the reduction of nitrogen oxide emissions from other sources.

As the borders with eastern Europe became more transparent, road traffic intensified. The completion of the European market in 1993 has increased road traffic even further, in particular that of commercial goods. As a consequence, automobile traffic as a source of air pollution undoubtedly will increase and not decrease as was initially expected after the introduction of the three way catalyst.

The following table gives an impression of the contribution of automobiles to the total air pollutant emissions from all sources in Germany (data from the German Environmental Service for 1987)

	Emission Rate	Percentage due to traffic
(million tons)		
hydrocarbons	2.47	53
nitrogen oxides	2.9	62
carbon monoxide	8.77	75
soot particles	0.22	30
carbon dioxide	719.3	20

The strong influence of emissions from automobiles on air quality in western Germany becomes particularly noticeable during the summer months when sunny periods lead to the development of photochemical smog characterized by concentrations of ozone often exceeding the maximum allowable concentration of 120 $\mu g/m^3$. Photochemical smog is produced by a complex series of chemical reactions caused by the interaction of hydrocarbons with nitrogen oxides in sunlight – the components released from automobiles.

The emission of hydrocarbons and other volatile organic compounds from sources other than automobile traffic is an issue that will require more attention in the future. Their total emissions in west Germany, including natural sources, was estimated as 2.4 million tons in 1989. Most of these compounds are released to the atmosphere in an uncontrolled way from leakages, evaporation of fuels, incomplete combustion of fossil fuels, and organic solvents. Thus it is difficult to set up a reliable emission inventory for these compounds. However, their potential for photosmog formation is considerable and must be added to that of hydrocarbons derived from automobile emissions.

The adverse effects of smog-laden air upon the vegetation has been known for a long time. It is possible that some of the forest damage observed in Germany is due to an increase in the number of summer smog episodes.

The problem of forest die-back

Since the early 1970s when the problem was first recognised, forest die-back has been one of the most prominent environmental issues in the former FRG. The visible signs of injury to the trees are discolouration and loss of needles or leaves leading to its crippling and eventual death. Although this type of damage had been observed earlier on a local scale, often caused by excessive emissions of SO_2 by industrial activity in the vicinity, the new type of forest damage is geographically widespread and particularly evident at higher elevations in mountainous terrain. The catastrophic death of entire forests predicted for the 1980s did not taken place. Continuous monitoring has shown that fir and spruce trees, which initially were most adversely affected, have improved again, whereas the damage of deciduous species such as beech and oak has worsened, so that they now appear more in jeopardy than coniferous forest. The German Environmental Service reported in 1990 that about 37% of all trees showed slight damage, 15.9% were substantially damaged and 41.7% were healthy. Trees more than 60 years old appeared to be more damaged than younger trees.

Since 1990 forest die-back in the former GDR has been measured by the methods used in the former Federal Republic. The results show that 29.8% of all trees are slightly affected, 35.9% are substantially damaged and 34.3% are healthy. These data indicate much more severe damage in eastern Germany than was hitherto apparent from available information.

Despite more than 10 years of research into the causes of forest die-back, it has not been possible to identify an unambiguous single cause-effect relationship. Specifically, the hypothesis of a viral or bacterial disease has received no support and had to be abandoned. Much of the evidence points towards an adverse influence of air pollutants combined with unfavourable soil conditions in some locations. Climatic fluctuations such as extended or annually recurring dry periods act as stress factors enhancing the damage. In the strongly affected alpine forests damage by wildlife and domestic animals impedes natural rejuvenation, and regulatory action in this area will be important in the future. On the whole, substantial reduction in the emission of air pollutants on a national as well as international scale is considered a vital prerequisite for the maintenance of healthy forests. Forest ecosystems react over long periods and in a complex manner to external forces such as the deposition of pollutants.

The maintenance of healthy forests is ecologically and economically significant. Because it is possible that automobile exhaust emissions are at least partly responsible for the damage of forests due to increasing the incidence of photosmog episodes, it will be necessary to achieve a more efficient reduction of emissions from mobile sources in the future. As discussed above, the expected increase in the transportation of goods and the associated intensification of road traffic are the problem. The technical potential for emission control of automobiles will be insufficient to effectively curb total emissions from this sector and other schemes of protection will have to be devised. Conceivable measures currently being debated are to channel commercial traffic from the road back to the rail, to increase the efficiency of using carrier loading space, to shorten distances between producer and consumer, and to reduce exhaust emissions by imposing speed limits in overburdened regions. How these measure can be implemented is a matter of future traffic policies, which can be dealt with only within the framework of the European Communities and not by Germany alone.

Forest die-back is linked to atmospheric pollution.

Global Warming

Triggered by the recent world-wide discussion of the global warming projected to arise from a growing injection into the atmosphere of carbon dioxide from fossil fuel combustion, and other green house active gases, the German government has made the reduction of emissions of these substances a central theme in its environmental policy. Together with other nations of the world, the government is actively pursuing ways of protecting the atmosphere on a global scale. According to OECD/UN statistics the per capita emission of CO_2 in 1986 was 12.34 tons in the former FRG and 21.2 tons in the former GDR, corresponding to 753.6 and 352.5 millions tons, respectively. The global emission rate for 1986 has been estimated as about 20 thousand million tons. By energy savings and more efficient use of fossil fuels there will be without doubt much room for further reduction of such emissions. In the long run, of course, it will be propitious to introduce new forms of energy. New technological developments will be necessary to achieve this ambitious goal. Nuclear energy has met with much resistance by the people of Germany in recent years, partly due to the Chernobyl accident and there are no plans to exploit this source of energy to a greater degree than has been done so far.

PAC Review

Pure and Applied Chemistry (*PAC*) is IUPAC's official journal. It publishes the main invited lectures of symposia sponsored by the Union; the recommendations of its Commissions on nomenclature, symbols and units, and technical reports on standardization, recommended procedures, collaborative studies and data compilations. Summaries of the most recent IUPAC recommendations on nomenclature and symbols, and technical reports appearing in *PAC* are published in *Chem. Intl.* in the section Recent Reports. In this section we take a brief look at the symposia and lectures published in recent issues of *PAC*.

Thermodynamics of solutions and biological systems

The international conference on Thermodynamics of Solutions and Biological Systems was held in New Delhi, India, on 3–6 January 1993. It was jointly sponsored by IUPAC, Indian National Science Academy, New Delhi, Indian Institute of Technology, New Delhi and Panjab University, Chandigarh.

About 150 scientists from 20 countries attended the symposium, the first such conference to be held in India, and, according to Programme Committee chairman I. Wadsö and conference editor and Programme Committee member D. V. S. Jain, it provided an excellent opportunity for younger Indian scientists to interact with leading international scientists in their fields.

Delegates at the symposium unanimously declared the meeting a great success both for its organization and scientific content. However, delegates expressed their disappointment that scientists from eastern Europe could not attend the symposium. Symposium delegates made the following recommendations:

1 A similar conference should be organized in India in three years' time.
2 Ways and means should be found for collaboration between scientists of developed and developing countries.
3 Effort should be made for greater participation of the scientists from East European countries in the next conference.

The scientific programme included invited and plenary lectures, oral presentations, and a poster session. The texts of 26 of the plenary and invited lectures have been published in the March 1994 issue of *Pure and Applied Chemistry*. The following subjects were covered at the symposium:

1 Thermodynamics of aqueous and nonaqueous solutions
2 Thermodynamics of systems of biological interest
3 Thermodynamics of emulsions and surfactants

Thermodynamics as a keystone of chemical engineering

In his inaugural address to the symposium, M. M. Sharma (Department of Chemical technology, Bombay University, Matunga, Bombay, India) reminded delegates of the crucial role thermodynamics plays in the chemical process industry. Sharma recalled the early work on thermodynamics of ammonia synthesis reminding delegates that its importance was so great, and the suspected non-ideal behaviour, that it led to the painstakingly well organized experimental measurements of equilibrium constants leading to pressures approaching 500 atm. It was a welcome relief to find non-idealities leading to increased conversions which were immensely helpful in industrial practice, he noted.

While Sharma highlighted some other important historic moments in thermodynamics, he also pointed to the subject's significance in recent times and its future potential. The predictive capabilities of thermodynamics will continually be on trial as new challenges, such as predicting thermodynamic data for a variety of solutes in aqueous solution for steam stripping that will lead to really vanishing levels, emerge.

Programme committee chairman I. Wadsö (Division of Thermochemistry, Chemical Center, University of Lund, Sweden) was one of the co-authors of a paper describing a modular microcalorimetric system for accurate work in several areas of basic and applied chemistry and biology. The system includes a very stable thermostatted water bath that can house up to four twin heat-conduction microcalorimeters. These calorimeters, the authors noted, are used with various flow vessels or insertion vessels ranging from simple closed ampoules to stirred vessels fitted with injection tubes, devices facilitating dissolution processes, electrodes, optical cables or equipment for electrochemical processes.

Programme organizing committee member, D. V. S. Jain (Panjab University, India) reported on work done in his laboratory on the thermodynamics of binary mixtures of alkylbenzenes. He reviewed the results of measurements for excess molar enthalpies, excess molar heat capacities and excess molar volumes of a number of mixtures consisting of alkylbenzenes reported from his laboratory and the literature data on similar systems. Jain noted that the behaviour of mixtures containing benzene and alkylbenzene is quite different from those mixtures in which both the components are alkylbenzenes. Jain explained these observations in terms of importance of orientational order present in pure benzene.

The structural stability of proteins is extensively controlled by the interactions between the protein and surrounding solvent molecules. Most marine organisms, not surprisingly, are iso-osomotic or slightly hyperosmotic to sea water. To achieve such a condition, marine organisms accumulate a variety of inorganic and organic osmolyte solutes, such as free amino acids or amino acid derivatives, in high concentrations. These osmolytes have to be compatible with protein function, avoiding major inhibitory or activating effects on enzyme activity.

J. C. Ahluwalia (Indian Institute of Technology, New Delhi, India), chairman of the national and local organizing committees, reported the results of his investigations, using differential scanning calorimetry, to obtain a quantitative estimate of the degree of stabilization of ribonuclease A (RNAase A) by amino acids and to correlate the results with the various interactions stabilizing the complex structure of the protein. Ahluwalia revealed that the transition temperature, heat ca-

(TOP LEFT) M. M. Sharma delivering the inaugural address (TOP RIGHT) I. Wadsö explaining why conference held in India (ABOVE) Aluwahlia welcoming the participants

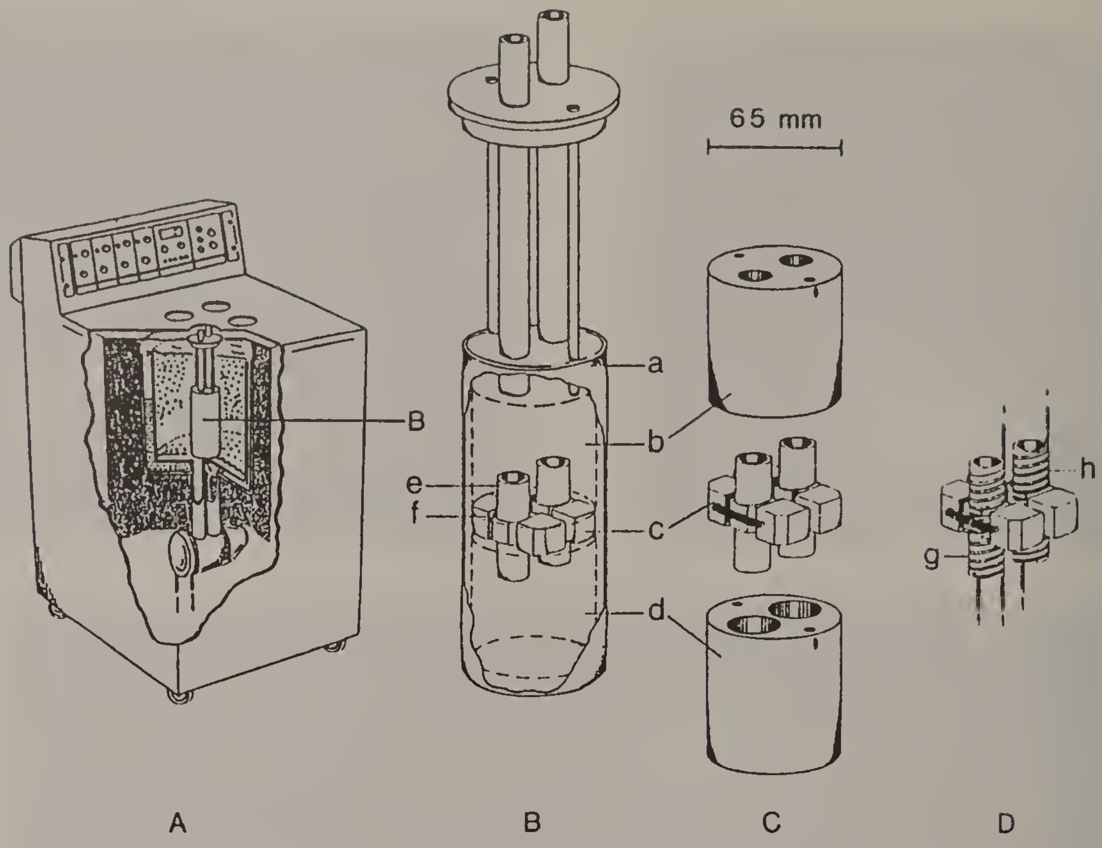
pacity and the enthalpy of denaturation of RNAase A in aqueous amino acid solutions at pH 6.00 has been determined. He noted that the thermal denaturation of RNAase A in amino acid solutions is a reversible two state transition between thermodynamically defined states. Moreover, the amino acids, except L-leucine impart thermal stability to the protein structure. Increasing the hydrophobic character of the amino acid added, decreases the thermal stability of the protein. Ahluwalia concluded that the thermodynamics of RNAase A denaturation in amino acid solutions can be explained on the basis of the cosphere overlap model.

Yu. M. Ostanevich (Joint Institute for Nuclear Research, Dubna, Russia) revealed that work he has conducted in collaboration with researchers at the Central Research Institute for Physics in Budapest, Hungary, shows that the small angle neutron scattering (SANS) technique offers some new possibilities to study the hydrophobic interactions in aqueous solution of rather small solute molecules. Ostanevich described how he and his co-workers used SANS to study the different aspects of hydrophobic interactions, such as their temperature and concentration dependence; solvent-separated versus contact-pair–solute interaction; and solute induced perturbation of the solvent structure.

Bio-organic chemistry

Bio-organic chemistry is an expanding, dynamic area of fundamental and practical interest to chemists. Consequently, it cannot have been much of a surprise that more than 500 scientists from 23 countries attended the second International Symposium on Bio-organic Chemistry, held in Fukuoka, Japan, on 6–10 June 1993. The symposium was organized under the sponsorship of the Chemical Society of Japan (CSJ) and IUPAC in collaboration with the Division of Biofunctional Chemistry of CSJ and held in conjunction with the 8th Annual Symposium of Biofunctional Chemistry of Japan and hosted by Kyushu University.

Since the first symposium held in New York in 1985, under the sponsorship of IUPAC and the New York Academy of Sciences, research interest in bio-organic chemistry has been both active and expanding. The agenda of the second symposium, according to organising committee chairman Yukito Murakami, was established to reflect the changes. Delegates were treated to five plenary lectures, 31 invited lectures, 127 short talks, and 200 poster presentations covering six major topics selected by the organising committee. Many of the plenary and invited lectures have been published



Basic units of the calorimetric system. A: The thermostatted water bath and electronic console. B,C: Twin microcalorimeter; a stainless steel can; b, c, d, aluminium blocks; e, ampoule holder; f, thermopile (Peltier effect plate). D: Flow calorimetric unit (which may be used with insertion vessels). g, mixing vessel; h, flow-through vessel.

in the April 1994 issue of *Pure and Appl. Chem.*

The following topics covered by the symposium:

1 Enzyme functions and modelling
2 Biological and artificial receptors
3 Biosynthetic pathways and biologically active molecules
4 Organic chemistry aspects of genetic engineering
5 Biopolymers and artificial supramolecular assemblies
6 Simulation of biochemical processes.

Continuous transition

In the opening lecture, Nelson J. Leonard (California Institute of Technology, USA) reminded delegates that the boundaries of research no longer end with organic chemistry – with the emphasis of structural, synthetic, or kinetic issues – but now involve biological material. The new technologies needed are being developed through efficient organic synthesis and spectroscopic analysis or are assimilated from advances in biological manipulations.

Nelson J. Leonard

Leonard told delegates that bio-organic chemistry is progressing at an accelerated pace and in ever broadening scope. Indeed, one of the most challenging topics in supramolecular chemistry is the mimicry of natural recognition processes. In his plenary lecture, David N. Reinhoudt (University of Twente, Netherlands), revealed how he and his co-workers have synthesized and evaluated artificial receptors for the complexation of potassium cations, neutral molecules, and anions. He also described the effect of crown ethers in enzymatic reactions in organic solvents.

Reinhoudt compared biological and synthetic receptors for three different types of guest species: valinomycin and calix[4]crown ethers for potassium ions; urease and metallomacrocycles for urea; and phosphate binding proteins and synthetic receptors for different anions. He also revealed that crown ethers can act as auxiliaries in enzymatic reactions in organic solvents having an accelerating effect on the reaction rate.

Mimicking nature is clearly a target for many groups. Minoru Isobe (Nagoya University, Japan) described the efforts of himself and his co-workers to investigate new bioluminescence systems. Isobe reported that three components are necessary in the chemiluminescence associated with the moon night mushroom, *Lampteromyces japonicus*, while the chromophore in the luminous squid, *Symplectotethis oulaniensis*, has been identified as dehydrocoelenterazine, which exists as a conjugate adduct in the photoprotein.

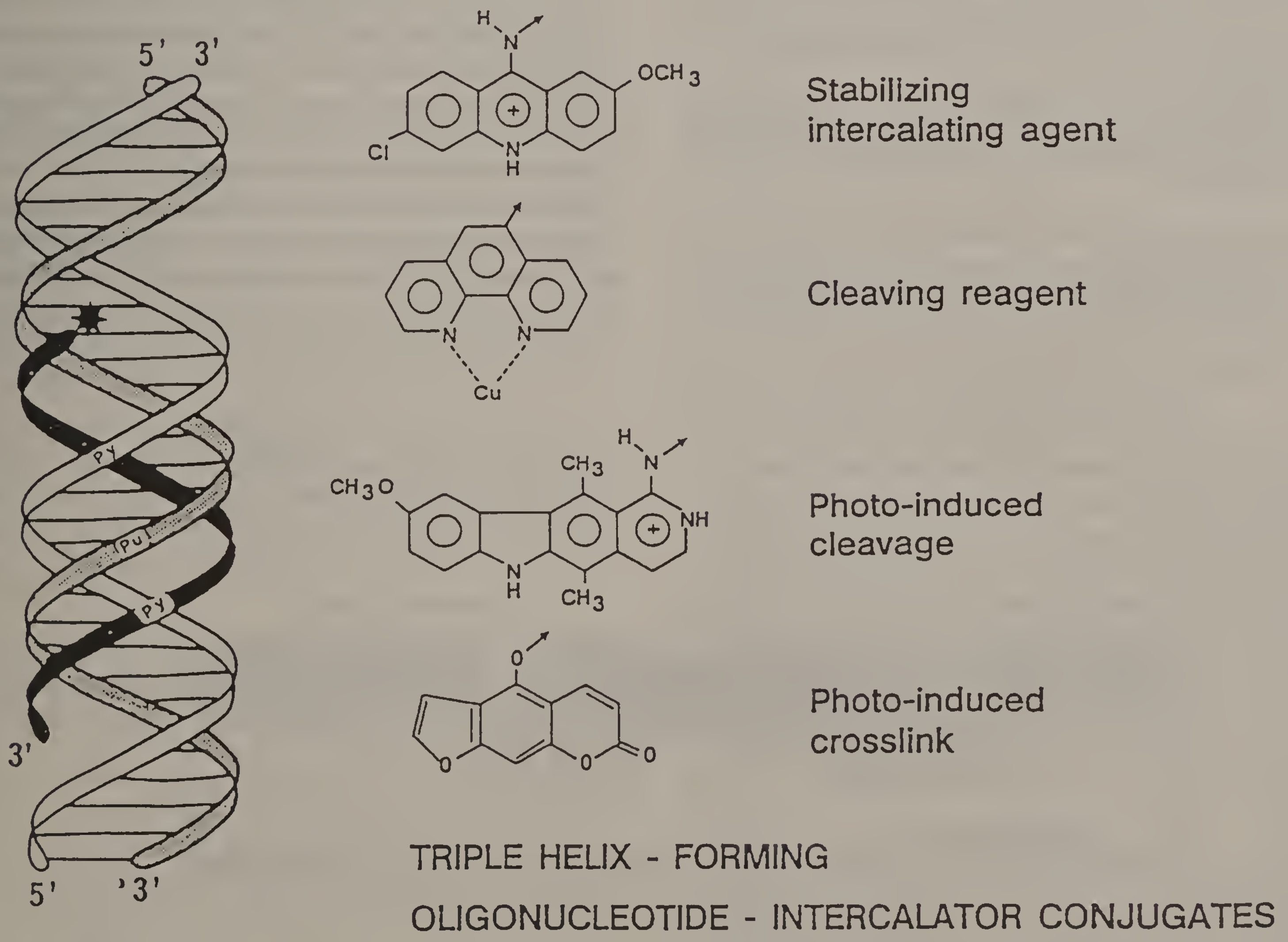
Eugene Grishin (Shemyakin and Ovchinikov Institute of Bioorganic Chemistry, Moscow) reported the isolation and characterization of neurotoxins from black widow spider venom, including the sequence determination of alpha-latroinsectotoxin, investigation of membrane receptors for isolated toxins and expression, in *Xenopus* oocyte membrane, of the receptor of alpha-latrotoxin – the black widow neurotoxin which effects only vertebrates by inducing massive releases of transmitters.

Better understanding of the transmitter:receptor interactions can help industry develop better pharmaceuticals and agrochemicals. In the plenary lecture, Bioorganic studies of transmitter receptors with philanthotoxin, Koji Nakanishi (Columbia University, New York) described work carried out in Columbia University, in collaboration with the University of Nottingham (Nottingham, UK), which involves making photolabile derivatives of analogues of spider and wasp toxins and using them to investigate the tertiary structure of the large membrane-bound transmitter receptor proteins by photoaffinity mapping and other techniques.

One of the most important biological complexes is DNA. Rational design of sequence specific DNA ligands is now an active field of research, according to Claude Helene (INSERM, Paris), in his plenary lecture to the symposium. He told delegates such ligands have great potential. They can: (a) provide molecular biologists with new tools to investigate the function of specific genes and the role of specific sequences in the control of gene expression; (b) aid in the development of sequence-specific artificial nucleases that could cleave long DNA fragments at selected sites to, for example, map genes on chromosomes; or (c) provide a rational basis for the development of new therapeutic agents based on modulation of gene expression.

Helene presented data on some of the most important recent advances in the field including the stabilization of triple helical complexes formed by oligonucleotides and double helical DNA. Polycyclic aromatic molecules such as benzol(e) pyrido indole derivatives, when covalently attached to a triplex-forming oligonucleotide, strongly stabilize the triple helix and have been shown to inhibit transcription both *in vitro* and in cell culture when targeted to the promoter region of the alpha subunit of the interleukin 2 receptor. The triple helix formation prevents DNA recognition by an essential protein (NF-kB) the binding of which is required to activate transcription from this promoter.

Sometimes what nature has provided needs correction. There are at least 4000 major human diseases caused by genetic defect. The advent of biotechnology offers the opportunity of so-called gene therapy, a process which would allow correction of the defect. The theory is in place, the challenge facing scientists is how to deliver the correct gene message. Jean-Paul Behr (CNRS, Strasbourg, France) described the opportunities offered by synthetic gene transfer vectors. Designed synthetic DNA carriers, he said, could be attractive alternatives to presently used viral vectors. Lipopolyamides, he revealed, have been developed which spontaneously condense DNA and coat it with a cationic lipid layer. The resulting nucleophilic particles transfect efficiently various eukaryotic cells.



A triple helix formed by a pyrimidine oligonucleotide (black ribbon) covalently linked to an intercalating agent (star). The intercalating agent binds at the triplex-duplex junction and can (I) stabilize the triple-helical structure (acridine derivative), (ii) induce double strand cleavage (phenanthroline), (iii) photo-induce cleavage (ellipticine derivative), (iv) photo-induce cross-linking of the two DNA strands (psoralen).

Recent Reports

In this section we publish summaries of the most recent IUPAC recommendations on nomenclature and symbols and technical reports. The full texts of these recommendations and reports are published in *PAC*.

Standard quantities in chemical thermodynamics Fugacities, activities and equilibrium constants for pure and mixed phases (IUPAC Recommendations 1994)

The standard chemical potential μ is defined in terms of a specified state of aggregation, a specified temperature and a specified standard pressure. Other standard thermodynamic quantities are obtained from μ by the usual mathematical operations.

In this report definitions are given for the standard chemical potential of a substance B in the following states of aggregation: gas phase whether pure or mixed, condensed phase whether pure or mixed, solvent substance in solution, and solute substance in solution. Fugacities and virial coefficients are introduced in the discussion of gases and activity, activity coefficients and osmotic coefficients in the discussion of condensed phases.

Expressions for the standard equilibrium constant are given for a reaction in the gas phase, in a condensed phase and in a solution.

This report was prepared for publication by M. B. Ewing, T. H. Lilley, G. M. Ologsson, M.T. Rätzsch and G. Somsen and published in Pure & Appl. Chem., 66, 533–552 (1994).

Vapour-liquid equilibria in alkan-1-ol + *n*-alkane mixtures (Technical Report)

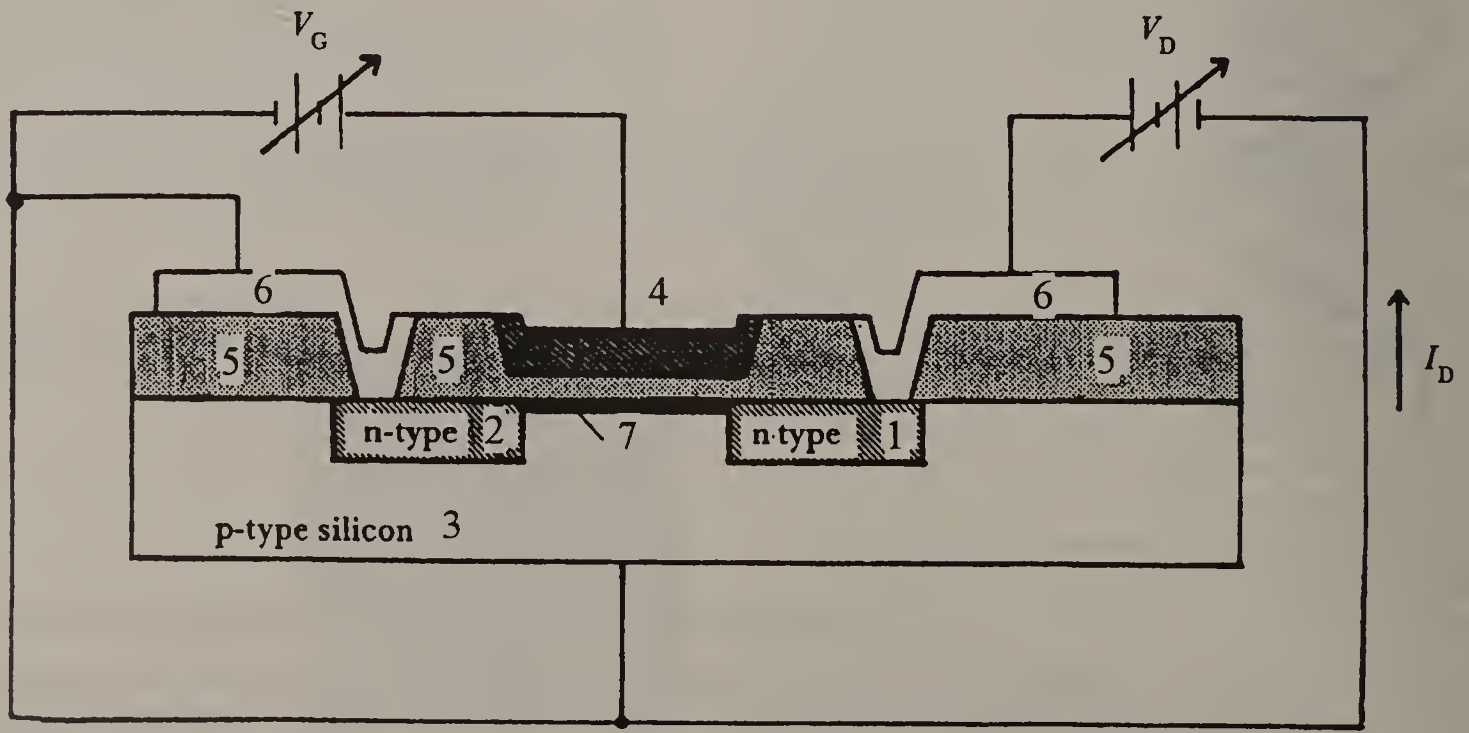
Recommended values are given for vapour-liquid equilibria, excess molar enthalpies, excess molar volumes, activity coefficients at infinite dilution and solid-liquid equilibria for binary alkan-1-ol + *n*-alkane mixtures. In addition, recommended values are reported for certain properties of the pure components: volumetric properties of gases, orthobaric liquid densities, compressibilities, critical properties, heat capacities, vapour pressures and enthalpies of vaporization.

This report was prepared for publication by John H. Dymond, IUPAC's Commission on Thermodynamics, subcommittee on thermodynamic data, Physical Chemistry Division, and published in Pure & Appl. Chem., Vol. 66, 553–564 (1994).

Terminology and conventions for micro electron ion-selective field effect transistor devices in electrochemistry (IUPAC Recommendations 1994)

In anticipation of the widespread use of ion-selective field effect transistors, this report makes recommendations about terminology and presentation of results in this interdisciplinary area. The terms gate voltage, drain current and gate bias potential are defined and experimental techniques for measurements with ISFETs are summarised.

It is proposed that the output signal potential difference is plotted so that variation with increase of logarithm of activity or concentration has a positive slope for cation-responsive devices and a negative slope for anion responsive devices.



Schematic diagram of an IGFET. (1) drain, (2) source, (3) substrate, (4) gate, (5) insulator, (6) metal contacts, (7) conducting channel.

This report was prepared for publication by A. K. Covington, Commission on Electroanalytical Chemistry, Analytical Chemistry Division, and the Commission on Electrochemistry, Physical Chemistry Division, and published in Pure Appl. Chem., Vol. 66, 565–569 (1994).

Symbols for fine and hyperfine structure parameters (IUPAC Recommendations 1994)

This report considers the symbols for fine and hyperfine structure parameters. Only those parameters for which the symbols are quite well established are considered, and those symbols are listed with their associated operators.

The discussion focuses on molecules in the gas phase, but reference is also made to the symbols used in electronic spin and electro paramagnetic resonance spectroscopy in the condensed phase where possible. Linear and non-linear molecules are considered separately.

This report was prepared for publication by Eizi Hirota, John M. Brown, Jon Hougen, Tadamasa Shida and Noboru Hirota, Commission on Molecular Structure and Spectroscopy, Physical Chemistry Division and published in Pure Appl. Chem., Vol. 66, 571–576 (1994).

Definitions of terms relating to phase transitions of the solid state (IUPAC Recommendations 1994)

This document provides definitions of phase transitions that relate specifically to the solid state. Various types of transition have been defined; they include: (i) structural transitions of the solid state, (ii) transitions related to the change in the state of matter, that is, from a solid phase to either a liquid or gaseous phase, or vice-versa, (iii) transitions related to changes in composition, (iv) metallurgical transitions, (v) transitions related to changes in the electronic structures of crystals, (vi) transitions that change thermodynamic properties or the disorder of a system, and (vii) liquid crystal transitions.

This report was prepared for publication by J. B. Clark, J. W. Hastie, L. H. E. Kihlborg, R. Metselaar and M. M. Thackeray, Commission on High Temperature and Solid State Chemistry, Inorganic Chemistry Division and published in Pure Appl. Chem., Vol. 66, 577–594 (1994).

Nomenclature for the presentation of results of chemical analysis (IUPAC Recommendations 1994)

Reporting data resulting from chemical analysis constitutes the critical, final state of the analytical process, This document presents nomenclature which is both statistically and chemically appropriate to this process. The terminology and formulation have been drawn from ISO Standards 3534 and other references.

The document covers three primary topics: (1) general terminology relating to the precision and accuracy of experimental results; (2) descriptive statistics appropriate for univariate analysis of chemical measurements, such as various measures of central value and dispersion, and formulae for calculating confidence intervals; (3) quantities employed in the estimation and application of linear calibration functions.

This report was prepared for publication by Lloyd A. Currie and Gyula Svehla, Commission on Analytical Nomenclature, Analytical Chemistry Division and published in Pure Appl. Chem., Vol. 66, 595–608 (1994).

Recommendations for nomenclature in laboratory robotics and automation (IUPAC Recommendations 1994)

The terminology used in laboratory automation and robotics has been derived from diverse backgrounds and is often vague, imprecise, and in some cases, in conflict with classical automation and robotic nomenclature.

These recommended terms have been assembled from standards, monographs, dictionaries, journal articles and documents of international organizations emphasizing laboratory and industrial automation and robotics. Where appropriate, definitions have been taken directly from the original source and identified with that source. However, in some cases no acceptable definition could be found and a new definition was prepared to define the object, term or action.

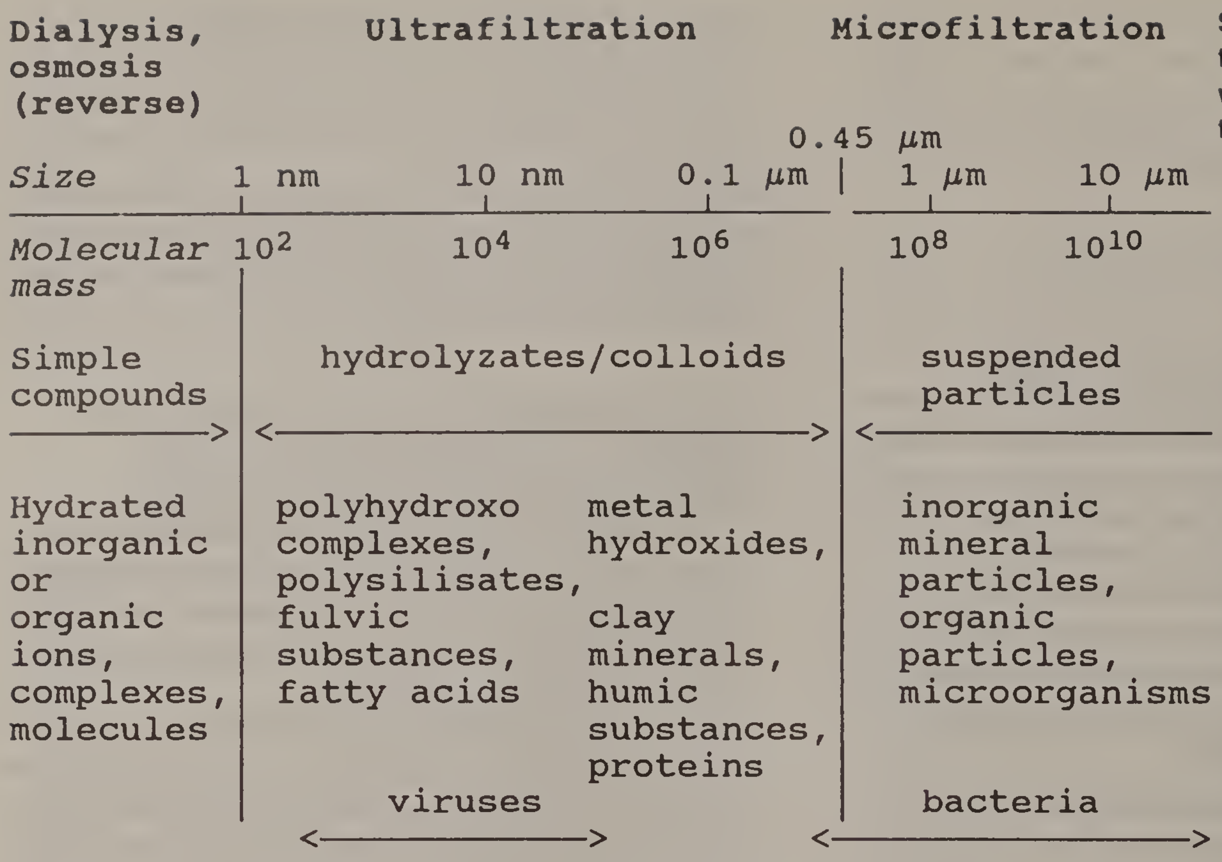
Attention has been given to defining specific robot types, co-ordinate systems, parameter, attributes, communication protocols and associated work stations and hardware. Diagrams are included to illustrate specific concepts.

This report was prepared for publication by H. M. Kingston and M. L. Kingston, Commission on Analytical Nomenclature, Commission on General Aspects of Analytical Chemistry, Analytical Chemistry Division and published in Pure Appl. Chem., Vol. 66, 609–630 (1994).

Separation and preconcentration of trace elements and their physico-chemical forms in aqueous media using inert solid membranes (Technical Report)

A survey is given of various methods for separation and enrichment of trace elements and their speciation in aquatic media using membrane filtration. The methods are mainly used for three purposes: (1) studies of size distribution patterns for trace elements in order to estimate the association of the elements with suspended particles and soluble compounds of a different nature, (2) preseparations of interfering constituents of solutions to be analysed in continuous flow instruments, (3) separation and preconcentration of inorganic ions in membrane filtration cells with and without chemical reagents.

The capabilities and limitations inherent in the methods are critically discussed, The most interesting results have been obtained for size fractionation techniques and for membrane separations in the presence of separating reagents. These and especially other membrane methods require further research to identify more clearly their respective advantages and limitations.


Dialysis, osmosis (reverse)
Ultrafiltration
Microfiltration
0.45 μm
Size
1 nm
10 nm
0.1 μm
1 μm
10 μm
Molecular mass
10²
10⁴
10⁶
10⁸
10¹⁰
Simple compounds
hydrolyzates/colloids
suspended particles
Hydrated inorganic or organic ions, complexes, molecules
polyhydroxo complexes, polysilisates, fulvic substances, fatty acids
metal hydroxides, clay minerals, humic substances, proteins
inorganic mineral particles, organic particles, microorganisms
viruses
bacteria

Scheme for speciation of trace elements in river water by size fractionation techniques.

This report was prepared for publication by B. Ya. Spivakov, V. M. Shkinev and K. E. Geckeler, Commission on Microchemical Techniques and Trace Analysis, Analytical Chemistry Division and published in Pure Appl. Chem., Vol. 66, 631–640 (1994).

Mercury (II) oxide and silver (I) oxide electrodes in aqueous solutions (Technical Report)

The standard aqueous potentials of the mercury (II) oxide electrode and of the silver (I) oxide electrode covering the temperature range from 283 to 318 K have been critically analysed (with specific attention to the standard states implied) and redetermined as a result, recommended values are tabulated for both the respective 'acid' and 'basic' standard potentials. From these potentials, accurate values for the standard solubility products of the corresponding hydroxides, $Hg(OH)_2$ and AgOH, have been derived.

The usefulness and applications of the mercury (II) oxide electrode, as well as the limited applicability of the silver (I) oxide electrode are described.

This report was prepared for publication by S. Rondinini, P. Longhi, P. R. Mussini and T. Mussini, Commission on Electroanalytical Chemistry, Analytical Chemistry Division and published in Pure Appl. Chem., Vol. 66, 641–647 (1994).

Recommendations for the electromagnetic determination of the pH of atmospheric wet deposition (acid rain) (Technical Report)

International studies to ascertain the extent of the environmental problems associated with the pH of atmospheric wet deposition (acid rain) are ongoing. Unfortunately, the measurement of pH in unbuffered, low ionic strength solutions, such as wet deposition, is prone to a variety of experimental difficulties which can compromise the validity of the data. Consequently it is essential that all investigators use measurement procedures that are consistent and reproducible.

This document provides recommendations on all aspects of the analytical process, including collection, handling and analysis of acid rain samples, to assure the quality and comparability of the resulting pH data.

This report was prepared for publication by R. A. Durst, W. Davison, and W. F. Koch, Commission on Environmental Analytical Chemistry, Commission on Electroanalytical Chemistry, Analytical Chemistry Division and published in Pure Appl. Chem., Vol. 66, 649–658 (1994).

Structure-based nomenclature for irregular single-stand organic polymers (IUPAC Recommendations 1994)

This document describes a structure-based nomenclature system for irregular single-strand organic polymers, i.e. single-stand organic polymers that can be described by the repetition of more than one type of constitutional unit or that comprise constitutional units not all connected identically with respect to directional sense.

The new system names irregular polymers for which the source-based system is inadequate, e.g. polymers that have undergone partial chemical modification, homopolymers having both head-to-tail and head-to-head arrangements of monomeric units, and polymers derived from a single monomer that can provide more than one kind of monomeric unit. In addition, it provides a structure-based alternative to source-based nomenclature for copolymers.

Irregular polymers, oligomers, or blocks are named by placing the prefix 'poly' before the structure-based names of the constitutional units; the latter are collectively enclosed in parentheses, with the names of the component constitutional units separated by oblique stokes. Block copolymers are named by using dashes for the bonding of blocks with each other and with junction units. With graft and star polymers, the grafts or the arms, respectively, are considered to be substituents to the main chain and the structure is named in the same way as a regular or irregular polymer.

This report was prepared for publication by R. B. Fox, N. M. Bikales, K. Hatada and J. Kahovec, Commission on Macromolecular Nomenclature, Macromolecular Division and published in Pure Appl. Chem., Vol. 66, 873–889 (1994).

Quantities and units for electrophoresis in the clinical laboratory (IUPAC Recommendations 1994)

Electrophoretic techniques are now widely used in the clinical laboratories and various kinds of quantities are used for the description of separation procedures. It is the purpose of this document to provide manufacturers and users of electrophoretic techniques with a list of relevant quantities and units consistent with the International System of Units (SI), and standards of the International Organization for Standardization (ISO).

This report was prepared for publication by R. G. Férard, Commission on Quantities and Units in Clinical Chemistry, Clinical Chemistry Division and Committee on Quantities and Units, International Federation of Clinical Chemistry, Scientific Division, and published in Pure Appl. Chem., Vol. 66, 891–896 (1994).

Quantities and units for centrifugation in the clinical laboratory (IUPAC Recommendations 1994)

The centrifuge is a widely used instrument in clinical laboratories for the separation of components. Various quantities are used for the description and calculation of the separation processes at centrifugation.

The aim of this document is to provide manufacturers and users of centrifuges with a list of quantities and units for centrifugation consistent with the International System of Units (SI), and standards of the International Organization for Standardization (ISO). The document includes an alphabetic list of 35 commonly used kind-of quantities for centrifugation with names, definitions, symbols and SI unit. A few practical examples of their use in calculation are also given.

This report was prepared for publication by M. Lauritzen, Commission on Quantities and Units in Clinical Chemistry, Clinical Chemistry Division and Committee on Quantities and Units, International Federation of Clinical Chemistry, Scientific Division, and published in Pure Appl. Chem., Vol. 66, 897–907 (1994).

Application of IUPAC–IFCC recommendations on quantities and units to WHO biological reference materials for diagnostic use

This document deals with the nature of WHO biological reference materials, their developments for the control of therapeutic substances and recommendations to improve their application in diagnosis. The nature of international units specified by WHO biological reference materials is contrasted with that of SI units, and the method for assigning values in international units to such reference materials is described.

The document recommends the use of SI units (mole) with existing and proposed WHO biological reference materials whenever the elementary entity of the stated component can be recognized. It also recommends that the description of quantities having no recognized kind-of-quantity with a definable dimension should be clearly distinguished by the term 'arbitrary' and include a reference to the procedure and calibrator used.

The WHO is urged to involve appropriate non-governmental organisations in advising on the need for and the suitability of international reference materials.

This report was prepared for publication by R. Dybkaer and P. L. Storring, Commission on Quantities and Units in Clinical Chemistry, Clinical Chemistry Division and Committee on Quantities and Units, International Federation of Clinical Chemistry, Scientific Division, and published in Pure Appl. Chem., Vol. 66, 909–913 (1994).

Standardized method for the estimation of β_2-microglobulin retinol-binding protein and albumin in urine

Increased excretion of proteins in urine are early signs of exposure to xenobiotics. These signs are parameters of an early effect on the kidney and may be used as biological effect parameter. Xenobiotics which may cause such effects are metals such as cadmium and lead, solvents such as toluene and styrene, and some pesticides.

Effects on the kidney tubuli are responsible for enhanced beta-2-microglobulin retinol-binding protein concentrations in urine, while effects on the glomeruli raise albumin levels in the urine. Standardization of methods to determine physiological concentrations will be necessary to compare the results of epidemiological studies. A protocol for such methods is described in which the proteins beta-2-microglobulin retinol-binding protein and albumin are determined routinely. Also a calibration curve program is presented.

The results of several comparison studies show that the methods described in the report are reasonably comparable between different laboratories.

This report was prepared for publication by Robert F. M. Herber, Alfred Bernard and Karlheinz Schaller, Commission on Toxicology, Clinical Chemistry Division, and published in Pure Appl. Chem., Vol. 66, 915–930 (1994).

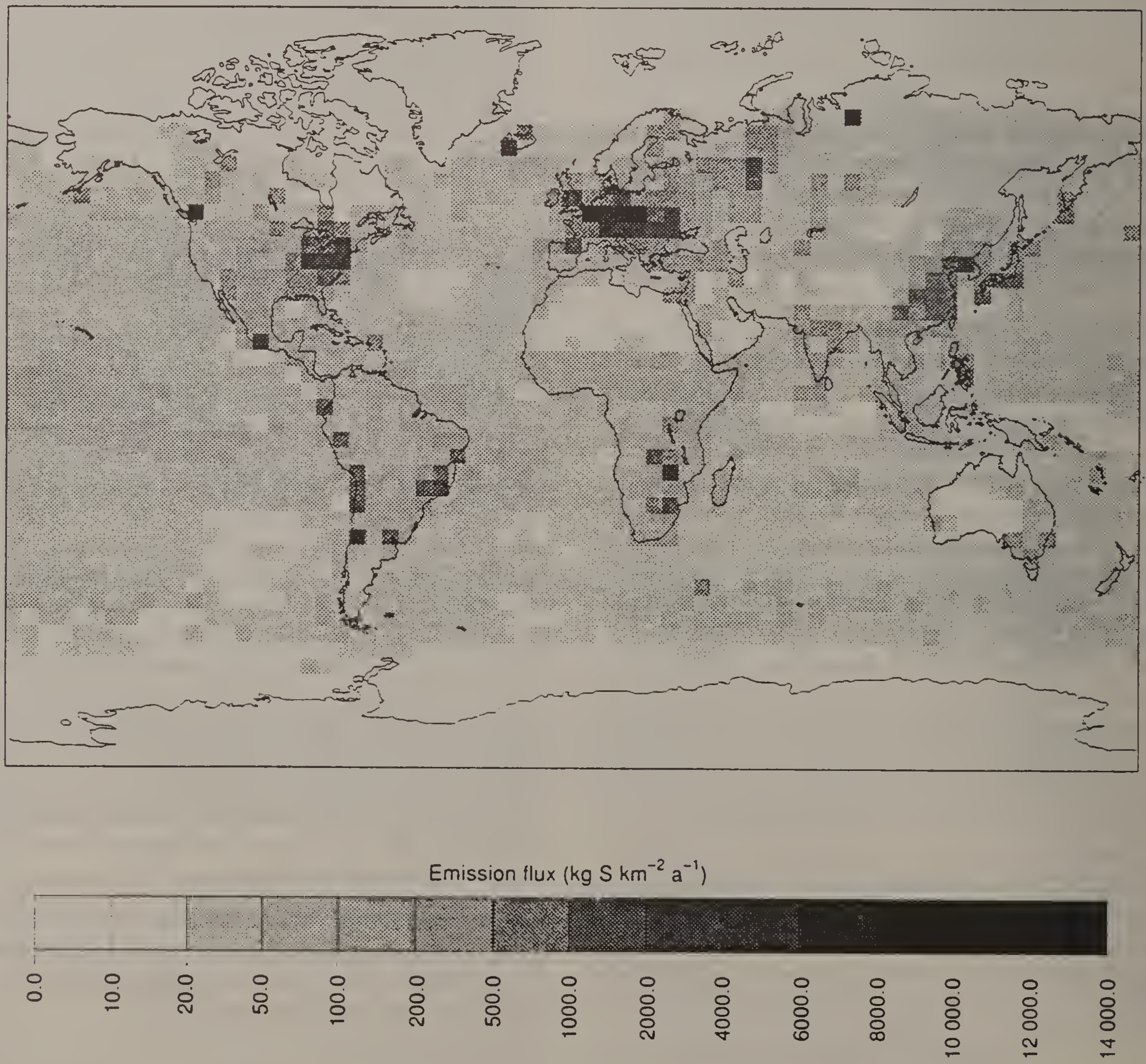
Publications

The Chemistry of the Atmosphere: its impact on global change

In his preface to the latest 'Chemistry for the 21st century' monograph, editor Jack Calvert (Boulder, Colorado, USA) says that one of the major concerns of the 21st century will be understanding the complex chemistry and physics of the atmosphere, learning to control the inputs to it so as to avoid significant degradation of the earth's atmosphere and devising solutions to problems as they are identified. Calvert highlights the appropriateness of the topic to the IUPAC chemistry for the 21st century series.

Chemistry of the atmosphere and its impact on global change was the focus of Chemrawn VII, organized by scientists of the IUPAC Commission VI-4 on Atmospheric Chemistry with the help of many others in several Commissions and Divisions of IUPAC and other scientific bodies around the world. In this book, the scientific discussions and evaluations of the state of the knowledge highlighted at that conference by leading atmospheric chemists are presented. Such evaluations formed the foundations for the publication which subsequently appeared with the recommendations of the Future Actions Committee of the conference, available in a separate publication.*

The authors of the 27 different chapters of this book represent some of the best atmosphere scientists. Their insight, Calvert adds, into and interpretations of the various atmospheric phenomena should prove valuable to both expert and novice. The book has been organized into six different sections, covering different aspects of the chemistry of the atmosphere. There is a common thread running through the discussions of seemingly diverse atmospheric problems. The basic chemistry which drives the different atmospheric changes is the same whether it is the destruction of ozone in the stratosphere, its formation in the troposphere, or the generation of acids and aerosols in the atmosphere.



Global distribution of yearly mean sulfur emissions in 1980, shown with 4° × 5° resolution.

Part 1 gives an overview of the research related to atmospheric chemistry and global change. The chapters in part 2 focus on several aspects of atmospheric chemistry that relate to stratospheric ozone depletion, perhaps the most dramatic and yet unexpected current atmospheric problem. Part 3 deals with one of the most important areas of atmospheric chemistry: methods of measurement of atmospheric trace species.

Part 4 introduces another major evaluation challenge: global warming and the 'greenhouse effect'. Discussions by several scientists show agreement that the potential for global warming through emissions and the build-up of the greenhouse gases (methane, carbon dioxide, chlorofluorocarbons, etc.) is increasing rapidly now; however, uncertainty remains in the magnitude and timing of the effects expected in theory. Part 5 deals with the important problem of build-up of ozone and other oxidants in the troposphere. Finally, in part 6, several authors summarize their findings relating to another atmospheric problem: acid development in the troposphere.

*J.W. Birks, J.G. Calvert & R. E. Sievers (eds), The Chemistry of the Atmosphere: Its impact on global change, CHEMRAWN VII, Perspectives and Recommendations. The Agency for International Development, Bureau for Science and Technology, Washington, DC.

The Chemistry of the Atmosphere: its impact on global change is edited by Jack G. Calvert and published on IUPAC's behalf by Blackwell Scientific Publications, Oxford, UK, 1994, xxi + 394 pp. ISBN 0–632–03779–2, GBP89.50.

Macromolecule–metal complexes

The March 1994 issue of Die Makromolekulare Chemie: Macromolecular Symposium (Vol. 80, 1–377) includes the invited lectures presented at the IUPAC-sponsored 5th International symposium on Macromolecule–metal complexes, held in Bremen, Germany, August 30-September 3 1993. According to symposium editor Dieter Wöhrle (University of Bremen, Germany), the focus of the meeting was on both fundamental and applied research in the rapidly expanding field of macromolecule metal complexes. More than 200 scientists from 25 countries attended the symposium.

The scientific programme of 24 lectures and 109 poster presentations concentrated on four topics:

1 Fundamental aspects of macromolecule metal complexes;
2 Related biological systems and medical, clinical aspects;
3 Catalysis and separation processes;
4 Electron and photon induced processes.

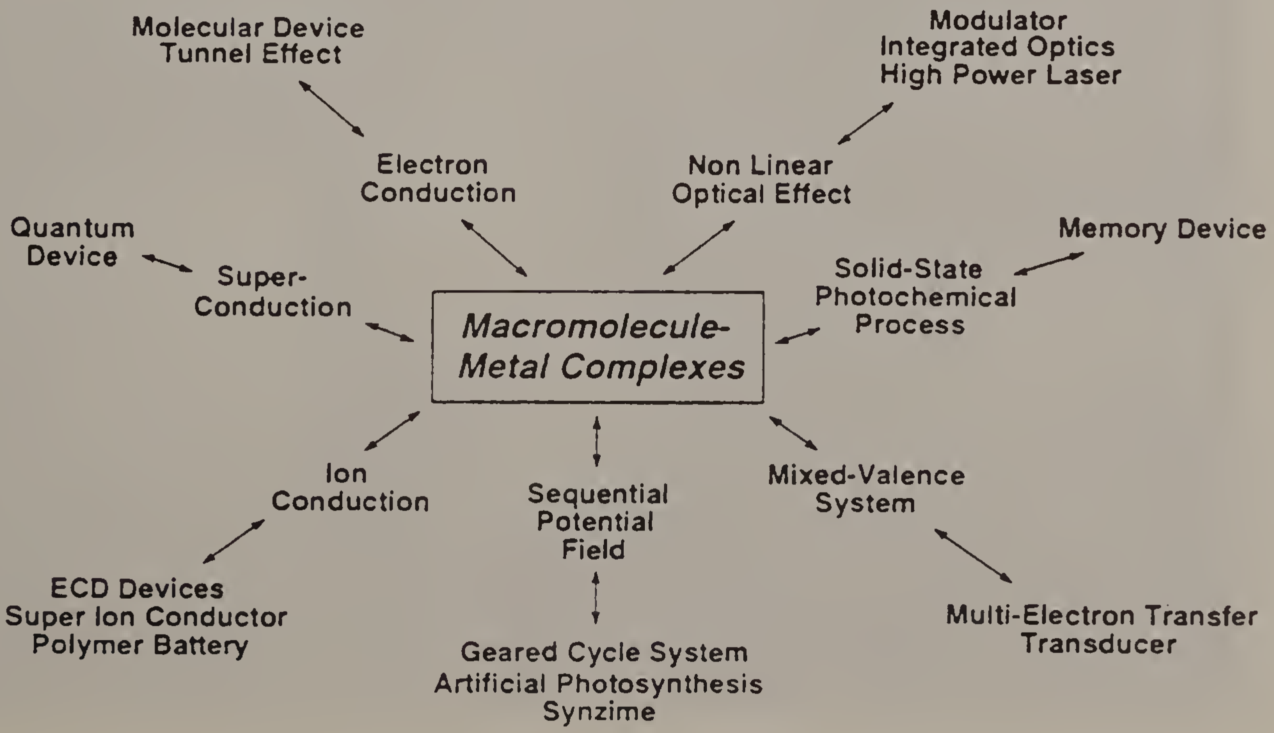
Eishun Tsuchida (Waseda University, Tokyo, Japan), who was initially active in bringing together scientists from different countries, describes the international activities, gives an historic overview of this rapidly expanding field, and highlights some of the new research trends.

Fluorinated polymers

Invited lectures presented at the IUPAC-sponsored 34th Microsymposium of macromolecules: fluorinated monomers and polymers, held in Prague, Czech Republic, in July 1993, have been published in the May 1994 issue of Die makromolekulare Chemie: Macromolecular Symposium (Vol. 82, 1–214). Fluorine as a substituent dramatically changes the properties of organic compounds. Consequently, fluorinated monomers and polymers are of great importance to academic and industrial researchers alike.

Research is yielding results and discoveries that can be exploited commercially in the development of new technologies and more advanced materials, note Microsymposium editor Jaroslav Kahovec (Prague, Czech Republic) and Microsymposium chairman Oldrich Paleta in the preface to the volume. Indeed, five of the papers came from researchers at four major chemical companies, including a report by Claude Tournut of Elf Atochem on the preparation and characterization of new copolymers of vinylidene fluoride, which have the potential to improve the durability of external coatings.

In addition to IUPAC sponsorship, the Microsymposium received the backing of the Czech Chemical Society, the Institute of Macromolecular Chemistry, Prague, and the Academy of Sciences of the Czech Republic. The volume contains the texts of 19 invited main and special lectures.



Potential in the field of macromolecule–metal complexes.

ISO Standards

The following are some of the new international standards announced by the International Organization for Standardization (ISO) in recent issues of ISO Bulletin:

April 1994 issue of ISO Bulletin

TC 45	**Rubber and rubber products**
ISO 1658: 1994	Natural rubber (NR) – Evaluation procedure
TC 47	**Chemistry**
ISO 11014–1: 1994	Safety data sheet for chemical products – Part 1: Content and order of sections
TC 138	**Plastics pipes, fittings and valves for the transport of fluids**
ISO 9967: 1994	Thermoplastics pipes – Determination of creep ratio
ISO 9969: 1994	Thermoplastics pipes – Determination of ring stiffness

May 1994 issue of ISO Bulletin

TC 17	**Steel**
ISO 439: 1994	Steel and iron – Determination of total silicon content – Gravimetric method
ISO 10701: 1994	Steel and iron – Determination of sulfur content – Methylene blue spectrophotometric method

June 1994 issue of ISO Bulletin

TC 17	**Steel**
ISO 4955: 1994	Heat – resisting steels and alloys
ISO 10698: 1994	Steel – Determination of antimony content – Electrothermal atomic absorption spectrometric method
ISO 10700: 1994	Steel and iron – Determination of manganese content – Flame atomic absorption spectrometric method
TC 28	**Petroleum products and lubricants**
ISO 6743–14: 1994	Lubricants, industrial oils and related products (class L) – Classification – Part 14: Family U (Heat treatment)
TC 42	**Photography**
ISO 418: 1976	Photography – Processing chemicals-Specifications for anhydrous sodium sulfite
ISO 423: 1994	Photography – Processing chemicals – Specifications for hydroquinone
ISO 3298: 1994	Photography – Processing chemicals – Specifications for glacial acetic acid
ISO 3625: 1994	Photography – Processing chemicals – Specifications for potassium hydroxide
ISO 3628: 1994	Photography – Processing chemicals – Specifications for boric acid, granular
ISO 10636: 1994	Photography – Processing chemicals – Specifications for anhydrous sodium thiosulfate and sodium thiosulfate pentahydrate
TC 43	**Plastics**
ISO 527–1: /1993 Cor 1: 1994	Technical Corrigendum 1
ISO 527–2: /1993 Cor 1: 1994	Technical Corrigendum 1
ISO 4892–1:1994	Plastics – Methods of exposure to laboratory light sources – Part 1: General guidance
TC 102	**Iron ores**
ISO 2596: 1994	Iron ores – Determination of hygroscopic moisture in analytical samples – Gravimetric and Karl Fischer methods

ISO publishes water quality compendia

Three volumes of the International Organization for Standardization (ISO) Standards Compendia in the field of water quality have just appeared. They contain the body of international standards so far in existence and are made up of the following: Water Quality. Vol. 1, General, ISBN 92-67-10192-7, 274 pp., CHF 116–; Vol. 2, Chemical Methods, ISBN 92-67-10193-5, 336 pp., CHF 134–; Vol. 3, Physical, biological and microbiological methods, ISBN 92-67-10194-3, 266 pp., CHF 108–.

These three volumes, ISO says, provide the ultimate source of information for international standards on water quality and, as such, will be almost practical and valuable source of reference. The three volumes are available in English and French from the ISO national member bodies or from ISO Central Secretariat, 1, rue de Varembé, 1211 Genève 20, Switzerland.

Japanese edition of the 'Purple Book' published

IUPAC's Compendium of macromolecular nomenclature (the 'Purple Book), which was prepared by W. V. Metanomski and published by Blackwell Scientific Publications (Oxford) in 1991, has been translated into Japanese by members of the committee of macromolecular nomenclature of Society of Polymer Science, chaired by Koichi Hatada (Osaka, Japan).

OUP publishes its first IUPAC Solubility Data Series Volume

Oxford University Press has published its first volume of the Solubility Data Series (Vol. 54: Polycyclic aromatic hydrocarbons in pure and binary solvents), under the terms of a new contract the publishing house has signed with IUPAC. OUP says it will publish the Series in journal format to allow publication of new results as quickly as possible, and so provide the most complete and comprehensive compilation of solubility data currently available. Each issue of the Series will continue to publish a compilation of the most up-to-date data on solubilities in all physical systems, including gases, liquids and solids. Presentation of numerical data and the details, OUP says, will continue to be influenced strongly by the perceived needs of prospective users.

The compilers of the latest volume have published solubility data for anthracene, naphthalene, phenanthrene, pyrene, fluorene, fluoranthene, carbazole, thianthrene, and other two- and three-ring polycyclic aromatic heteroatom compounds in binary organic solvent mixtures so that experimental values will be readily available in a single reference source. Experimental data for well over 250 different systems were retrieved from the chemical literature and are compiled in the volume. Each system contains solubility data for the solute dissolved in each pure solvent and in four to ten binary solvent mixtures covering the entire range of mole fraction compositions.

Strengthening basic and applied science education in developing countries

Executive committee members of the International Council of Scientific Unions (ICSU) committee on science and technology in developing countries (COSTED) have published the proceedings on an international seminar which focused on strengthening basic and applied science education in developing countries and in Trieste, Italy, on 5 April 1993. Hosted and co-sponsored by the Third World Academy of Sciences (TWAS), the meeting attracted 30 participants who heard a keynote address by A. Badran, assistant director general, UNESCO, entitled 'Basic and Applied Science in the World – Past Strategies and Present Status', as well as presentations looking at the current status of science in specific regions and the trends and needs of the 21st century.

The proceedings include the presentations and details of the concluding session of the seminar which was devoted to focused discussions on the problems encountered in strengthening science education in developing countries. The proceedings reports the recommendations that emerged from the discussions. Government support for science education emerged highest on the recommendation priority list, although educational reforms to help developing countries keep pace with emerging global trends in science and technology feature strongly.

COSTED can be contacted at: COSTED Central Secretariat, 24, Gandhi Mantap Road, Madras 600 020, India. Tel: +91 (44) 419466. Fax: +91 (44) 414543.

Chemistry for development in Vietnam

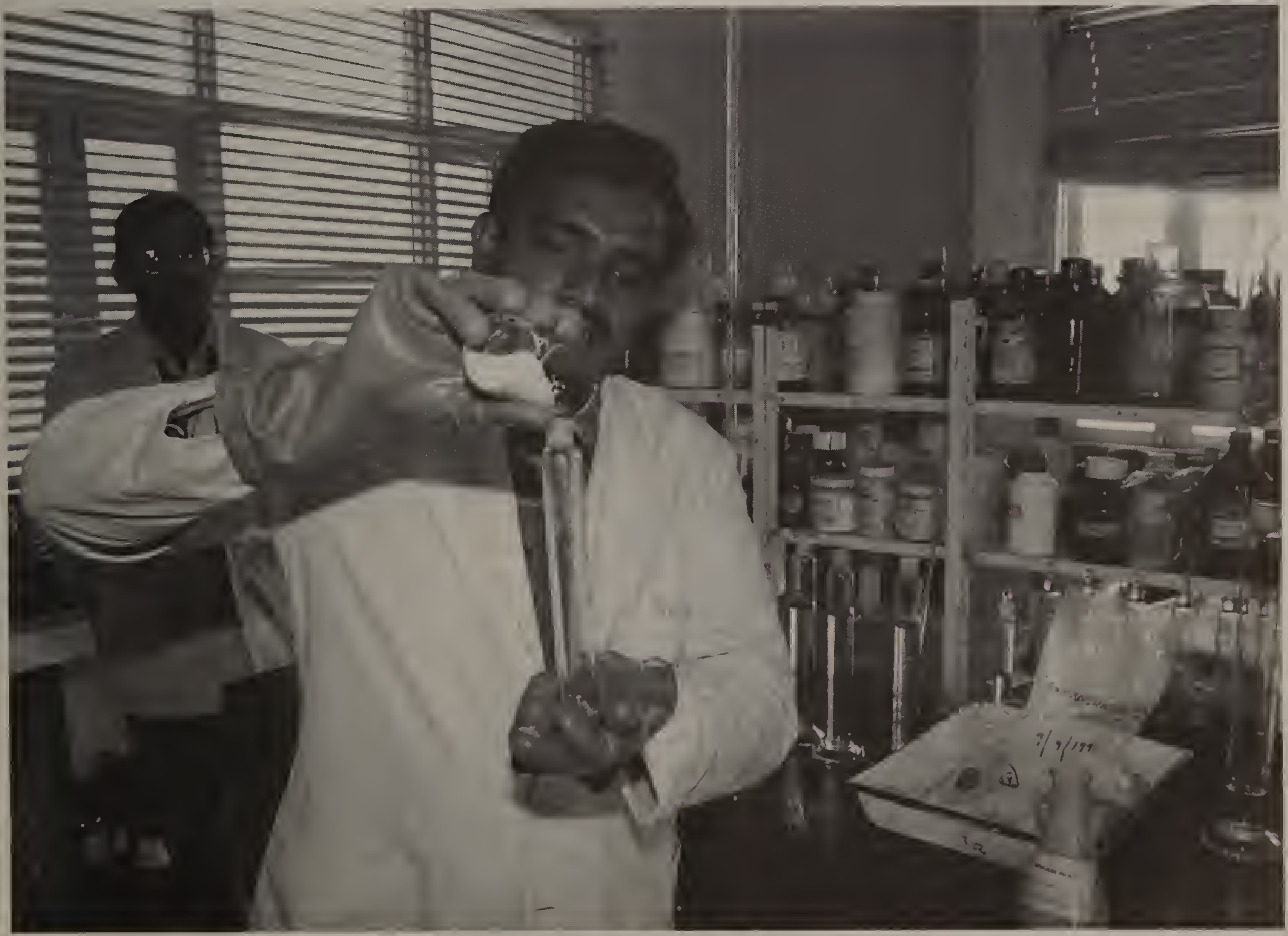
The Chemical Society of Vietnam has published the proceedings of its 2nd national congress on chemistry which was held 7–9 December, 1993 in Hanoi, Vietnam. The report publishes abstracts of seven plenary lectures and 517 other presentations. Most of the presentations highlight developments that are taking place in Vietnam, a country with IUPAC observer status, although a number of papers were given by scientists from laboratories elsewhere in the world including the USA, Japan, India and Europe.

Further details are available from CSV, 2 Pham Ngu Lao, Hanoi, Vietnam. Tel: +84 267498. Fax: +84 4 250000.

The role of science and technology education in capacity building in developing countries

The International Council of Scientific Unions (ICSU) committee on Science and Technology in Developing Countries (COSTED) and the ICSU Committee on Teaching of Science (CTS) have published the proceedings of a plenary seminar entitled 'The role of science and technology education in capacity building in developing countries', which was held 4 October 1993 in Santiago, Chile.

The document publishes a background paper, prepared by COSTED and CTS prior to the seminar, three presentations from representatives of Latin America, Africa and Asia looking



at the role of science education in capacity building in those regions, respectively, as well as a paper from CTS. Contributions made during the feedback session have been included as have the recommendations that emerged from the seminar.

COSTED can be contacted at: COSTED Central Secretariat, 24, Gandhi Mantap Road, Madras 600 020, India. Tel: +91 (44) 419466. Fax: +91 (44) 414543.

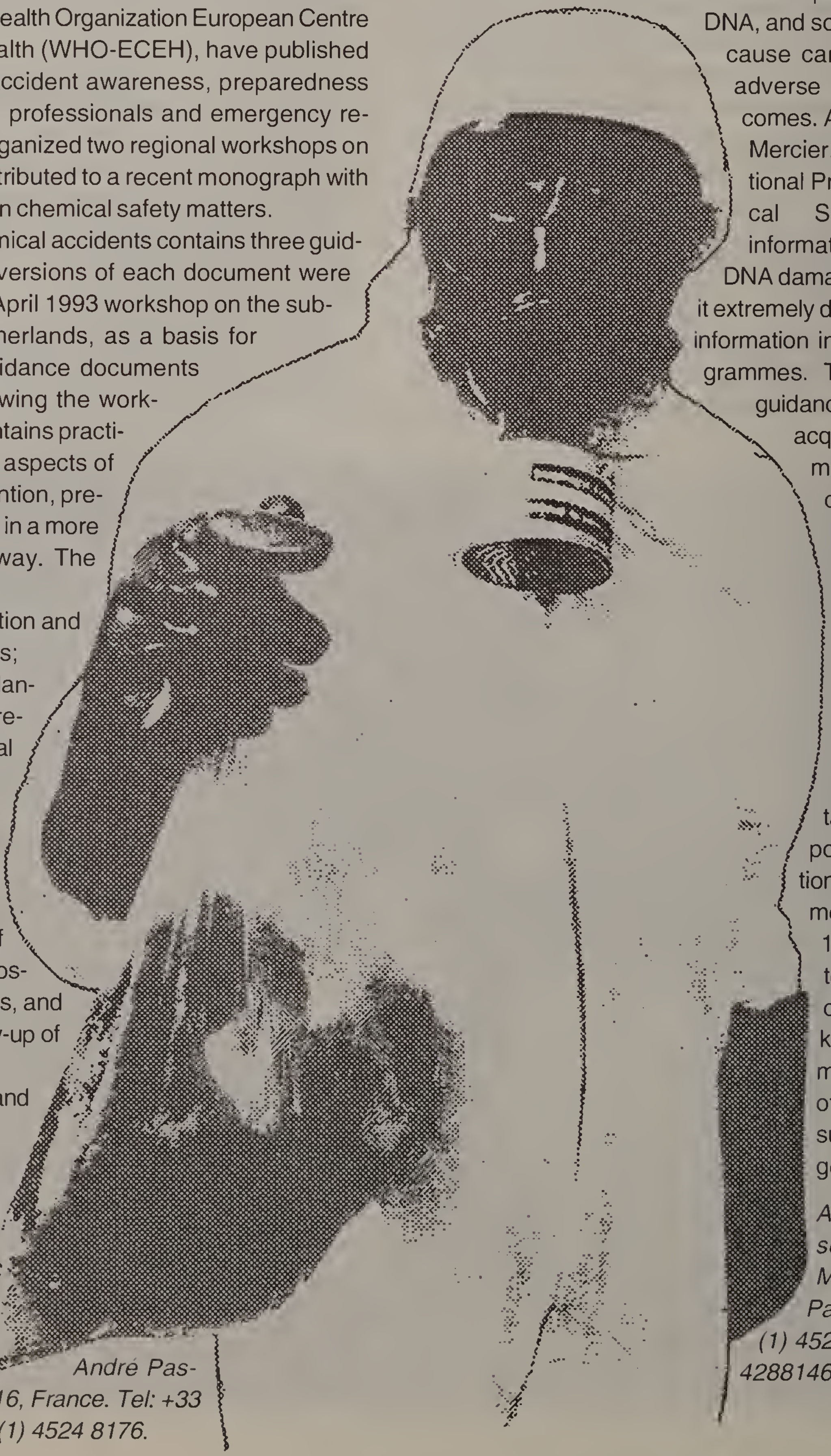
Health aspects of chemical accidents

The Organization for Economic Co-operation and Development (OECD), the International Programme on Chemical Safety (IPCS), the United Nations Environment Programme Industry and Environment Programme Activity Centre (UNEP IE/PAC), and the World Health Organization European Centre for Environment and Health (WHO-ECEH), have published guidance on chemical accident awareness, preparedness and response for health professionals and emergency responders. IUPAC has organized two regional workshops on chemical safety and contributed to a recent monograph with WHO/IPCS and UNEP on chemical safety matters.

Health aspects of chemical accidents contains three guidance documents. Draft versions of each document were prepared for the 13–16 April 1993 workshop on the subject at Utrecht, the Netherlands, as a basis for discussion. All three guidance documents have been revised following the workshop. The report also contains practical guides, which health aspects of chemical accident prevention, preparedness and response in a more detailed and technical way. The practical guides cover:

- health-related information and communications needs;
- the organization and planning of health-related response to chemical accidents;
- health aspects of chemical accident response – including treatment at the accident site, transport of victims, treatment at hospitals and other facilities, and rehabilitation and follow-up of victims;
- health-related training and education.

Further information about this report, OECD Environment Monograph No. 81, UNEP IE/PAC Technical Report No. 19, can be obtained from OECD, 2, rue André Pascal, 75775 Paris, Cedex 16, France. Tel: +33 (1) 4524 8200. Fax: +33 (1) 4524 8176.



Methods to assess DNA damage and repair: interspecies comparisons

The Scientific Committee on problems of the Environment (SCOPE) of the International Council of Scientific Unions (ICSU) has recently published a report entitled 'Methods to assess DNA damage and repair: Interspecies comparisons'. The monograph, SCOPE 51, the product of a workshop convened by the Scientific Group on Methodologies for the Safety Evaluation of Chemicals (SGOMSEC) and held at the National Institute of Environmental Health Sciences, Research Triangle Park, North Carolina, USA in March 1990, is concerned with a subject basic to chemical risk assessment: DNA repair and damage.

Numerous chemical and physical agents in the environment are capable of reacting with DNA, and so have the potential to cause cancer, mutations and adverse reproductive outcomes. According to Michel J. Mercier, manager of International Programme on Chemical Safety, the rapid information growth related to DNA damage and repair makes it extremely difficult to integrate the information into public health programmes. This report provides guidance for the structured acquisition of key information to reduce cancer risks throughout the environment.

The report includes general recommendations aimed at improving research in the field and developing methodologies for genotoxicity testing, taking account of the potentials and limitations of available animal models. It also includes 10 contributed chapters evaluating the current state of knowledge to estimate the risk to health of humans exposed ti substances that alter genetic material.

Address of SCOPE secretariat: 51 bd de Montmorency, 75016, Paris, France. Tel: +33 (1) 45250498. Fax: +33 (1) 42881466.

IUPAC Handbook 1994–1995

Published for the International Union of Pure and Applied Chemistry
by Blackwell Scientific Publications Ltd

The 1994–1995 Handbook is intended to provide, in one volume, detailed information on the membership, working programmes, and rules of operation of IUPAC. It will be a useful reference source for chemists and chemical organizations world-wide.

IUPAC

Outline of Contents: Organization chart of IUPAC 1994–1995, objectives of IUPAC, its Officers and Secretariat; Past Officers; General Assemblies and Congresses; National Adhering Organizations; Observer Countries; Associated Organizations; Company Associates; Executive Committee and Bureau; Standing Committees; Divisions/Section and their Commissions, Subcommittees, working Parties and Sub-groups; Pool of Titular Members; Standing Orders from Executive Committee; Guidelines for IUPAC representation at meetings of international/regional organizations; Alphabetical Index to members of IUPAC bodies 1994–1995; Current Programmes 1994; guidelines for IUPAC programmes; Appendix I: Reports published during 1992–1993; Appendix II: Guidelines for applying for sponsorship of Symposia, Symposia sponsored by IUPAC (as at 30 April 1994); Appendix III: Procedure for comment and approval of IUPAC recommendations on nomenclature and symbols; Guidelines for drafting IUPAC Recommendations 1994; Appendix IV: Recommended policies and procedures for handling copyright in IUPAC projects; Statutes and Bylaws; Appointment and functioning of National Representatives; Rules and Terms of reference for divisions/ Section and commissions Affiliate Membership Programme; List of Abbreviations.

1994. 264 pages. £25. approx./US$37.50. approx. Members discount Price £15/US$22.50. ISBN 0 86542 848

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Tests, Methods, and General Requirements; Quality Specifications for Pharmaceutical substances, Excipients, and Dosage Forms

The International Pharmacopoeia, 3rd edn, Vol. 4, Tests, Methods, and General Requirements; Quality Specifications for Pharmaceutical substances, Excipients, and Dosage Forms, Published by WHO, 1994, xv + 343 pp. (available in English; French and Spanish in preparation), ISBN 92-4-154462-7. CHF85.–/USD76.50; In developing countries CHF59.50. Order No. 1154091.

This volume in the third edition of The International Pharmacopoeia provides a collection of recommended quality specifications and methods of analysis for selected pharmaceutical products, excipients, and dosage forms. Recommended procedures are intended to serve as source material for reference or adaptation by any WHO Member State wishing to establish pharmacopoeial requirements. Tests described in the volume are designed to determine impurities on which attention should be focused, to fix the limits of those that are tolerable to a certain extent, and to indicate methods for ensuring the absence of those that are undesirable. In most cases, recommended tests rely on simple, classical chemical techniques suitable for use in developing countries.

The volume has two parts. The first offers guidance on the correct performance and application of certain general tests and other methods used in quality control, followed by general requirements pertaining to the testing of different dosage forms. The second and most extensive part presents monographs for 24 substances included in the WHO Model List of Essential Drugs. Each monograph provides exact instructions concerning which tests are required and which method should be used.

For the first time in this edition, the volume also provides monographs for excipients, including solvents, acidifying agents, tablet and capsule binders, diluents, suspending agents, viscosity-increasing agents, stabilizers, and surfactants. The volume concludes with monographs for 39 finished preparations formulated as capsules, tablets, injections, and powders for injections.

Environmental Health Criteria

The *Environmental Health Criteria series* is published under the joint sponsorship of the United Nations Environment Programme (UNEP), the International Labour Organization (ILO) and the World Health Organization (WHO). There are now 157 titles in the series. Reports Nos 1–86 were reviewed in the September 1990 issue of *Chem. Intl.* (pp. 197–201); Nos

87–101 in the March 1991 issue (p.68); Nos 102–115 in the September 1991 issue (pp. 182–186); and Nos 116–141 in the March issue 1994 (pp. 58–64).

The following are descriptions of a selection of the more recent titles based on the WHO new book announcements.

Polybrominated biphenyls

Environmental Health Criteria, no. 152, Published by WHO 1994, 577 pages (English, with summaries in French and Spanish). ISBN 92 4 157152 7, CHF79.0/USD71.10, in developing countries: CHF55.30, order no. 1160152

This volume evaluates the risk to human health and the environment posed by exposure to polybrominated biphenyls (PBBs). These chemicals were used in the manufacture of small appliances and in automotive applications, coatings, lacquers, and polyurethane foam.

Research on these chemicals has been especially intense following a 1973 poisoning disaster, in Michigan, USA, caused when the flame retardant FireMaster® was inadvertently confused with magnesium oxide-based cattle feed supplement. the ensuing contamination of farm animals remained undetected for almost a year. Thousands of farmers and other consumers were exposed to PBBs through the consumption of contaminated meat, eggs and dairy products.

Close to 600 studies were critically assessed in an effort to reach definitive conclusions concerning the risks posed by these highly persistent chemicals. Sections concerned with the presence of PBBs in the environment and sources of human exposure summarise the many ways in which PBBs can enter the environment. The report cites abundant evidence indicating that the major part of the total volume produced will ultimately enter the environment. The report also cited evidence that PBBs are poorly metabolised, with half-lives in humans of 8–12 years or longer, and bioaccumulate in human milk.

An evaluation of effects on organisms in the environment draws heavily on studies of the clinical signs and pathological changes seen in contaminated farm animals following the Michigan disaster. The most extensive section assesses the large number of studies conducted in experimental animals and *in vitro* test systems.

Although the exact mechanisms of toxic action remain to be elucidated, the report notes the pronounced accumulation of some PBB congeners, the poor ability of the body to metabolize and eliminate them, and resultant build-up of the chemical in the body to an extent that overcomes compensatory mechanisms.

Although numerous clinical studies of exposed Michigan farm residents have been conducted, the report cited major flaws in most of these studies that make it virtually impossible to draw clear conclusions concerning the health effects of exposure.

Citing overwhelming evidence from other sources, the report concludes that humans and the environment should not be exposed to PBBs and that commercial use of these compounds should cease.

Carbaryl

Environmental Health Criteria, No. 153, Published by WHO, 1994, 358 pages (English, with summaries in French and Spanish). ISBN 92 4 157 153 5. CHF51.00/USD49.90. In developing countries: CHF35.70. Order no. 1160153.

This report evaluates the design and finding of over 700 studies in an effort to determine the risks to human health and the environment posed by carbaryl. This broad spectrum contact and ingestion insecticide has been widely used for over 30 years to control various insect pests on food and fibre crops, trees, and ornamentals. In veterinary practice, carbaryl is used to control flies, mosquitos, ticks and lice in cattle, poultry and pets. The compound is also used to treat body louse

Carbaryl is used to control ticks and lice in cattle.

infestation in humans. Carbaryl is currently processed by more than 290 formulators into over 1500 different registered products.

The opening sections discuss methods of detection and analysis and evaluate the many factors that influence the behaviour of carbaryl in the environment. Abundant data support the conclusion that the compound is rapidly degraded, does not persist in the environment, does not readily leach into ground water, and should not cause harmful short-term effects on the ecosystem.

The most extensive section reviews the large number of experiments designed to assess the toxic effects of carbaryl and elucidate its mechanisms of action. These studies, supported by limited data on humans, confirm that carbaryl poses no risk of inducing genetic changes in either the somatic or the germinal issue of humans.

On the basis of these evaluations, the book concludes that, under normal conditions of use, carbaryl posed a low risk to the environment and to the heath of the general population. Levels detected in food and drinking water are far below the acceptable daily intake and thus unlikely to endanger health. When reasonable safety precautions and measures for personal protection are enforced, occupational exposure to carbaryl during manufacture, formulation and application will not create health hazards for workers.

Hydroquinone

Environmental Health criteria, No. 157, Published by WHO, 1994, 178 pages (English, with summaries in French and Spanish). ISBN 92 4 157 157 8. CHF27.00/USD24.30, in developing countries: CHF18.90. Order no. 1160157.

This book evaluates the risks to human health and the environment posed by exposure to hydroquinone, a chemical found, in natural form, in a number of plants and animals. A review of data on the physicochemical properties of hydroquinone and its behaviour in the environment concludes that most of this compound is distributed to the water compartment, where it is degraded by both photochemical and biological processes. The report found no evidence of persistence in the environment or bioaccumulation. Studies of the kinetics and metabolism of hydroquinone support the conclusion that this compound is rapidly absorbed, rapidly and widely distributed among tissues and rapidly excreted.

The most extensive section evaluates studies of toxic effects in experimental animals and *in vitro* test systems. These studies have concentrated on the investigation of dermal and ocular effects, effects on reproduction, immunotoxicity, neurotoxicity, nephrotoxicity, and carcinogenicity, Particular attention is given to recent studies indicating that co-exposure to hydroquinone and various other phenolic compounds can greatly potentiate the toxic effects of the individual compounds, causing a variety of cytotoxic, immunotoxic, and genotoxic effects.

An evaluation of effects on human health cites findings from case reports of accidental and intentional poisoning, short-term controlled human studies, and epidemiological studies of respiratory effects and carcinogenicity in occupationally exposed workers. Studies designed to assess the safety of hydroquinone in cosmetic skin-lightening products are also reviewed. Although data were judged inadequate to evaluate carcinogenic potential, the report notes a well-documented association between exposure to hydroquinone and various skin disorders. Long-term exposure to airborne hydroquinone has been observed to cause a range of ocular disorders, including eye irritation, sensitivity to light, staining of the cornea and conjunctiva, corneal opacities and visual disturbances.

Citing evidence that skin-lightening creams containing hydroquinone are frequently inadequately labelled and contain concentrations exceeding the permitted limit, the report recommends that over-the-counter sale of these products be restricted. The report also calls for the development of health education programmes to discourage the use of these creams for whole body skin lightening.

Provisional Recommendations

IUPAC seeks your comments

In this section we publish synopses of IUPAC's latest provisional recommendations on nomenclature and symbols. All comments on these recommendations are welcome and will be taken into consideration. The final revised versions are published in *Pure and Applied Chemistry* and synopses of these are published in *Chem. Intl.* as recent reports.

If you would like to comment on the Provisional Recommendations please write to your nearest national/regional centre requesting a copy of the full report. Copies are not available from the IUPAC Secretariat.

Glossary of terms relating to the chemistry of pesticides (IUPAC Recommendations 1994)

This glossary contains definitions of over 270 terms frequently used in relation to the chemistry, regulation and use of pesticides. A wide range of disciplines are involved in this field and the glossary was developed as a step in facilitating communication between researchers, government regulatory authorities and chemists in associated professional areas. the range of terms includes pesticide residues, sampling for analysis, good laboratory practice, metabolism, environmental fate, effects on ecosystems, computer simulation models, toxicology and risk assessment.

Comments on the document are welcome and should be sent by 31 January 1995 to: P. T. Holland, HortResearch Institute NZ Ltd., Ruakura Research centre, Hamilton, New Zealand.

Commission & Committee News

Tales from Vienna: High temperature and solid state chemistry

The Commission on High temperature and Solid state Chemistry (II.3) met in Vienna following a highly successful IUPAC High Temperature Materials Chemistry Conference in April that had been organised by our Viennese hosts. The Commission reviewed the status of publications from a number of projects; received progress reports and plans for recently initiated projects; and developed plans to initiate and review potential new projects.

Publications

An article on the teaching of solid-state chemistry has been published in *Chemistry International.* The associated continuously updated bibliography is available through the IUPAC Secretariat. Supporting experiments are being solicited for preparation of a companion publication describing laboratory exercises.

A paper on Phase Transition Terminology, and a list of 122 terms defining Terminology of Carbon will be published in *Pure and Applied Chemistry* together with the Commission's report on Nomenclature of Graphite-Intercalation Compounds which will also be included in the new Red Book.

Two articles and two conference presentations have been prepared describing the results of a collaborative round-robin study of the Ionic Conductivity of Fluorite Structured Oxides.

The results of a round-robin experimental study on the Determination of Glass Composition by Electronic Probe Microanalysis are being worked up for publication while a manuscript describing Recommendations for the Characterisation of SiC Powders is being readied for Commission review. A draft manuscript clarifying Terminology for Diffusion in the Solid State is being readied for external review and the recommendations of the working party on Fullerene Nomenclature and Terminology have been presented to IDCNS.

Recently initiated projects

The task force on Surface and Interface Analysis of Ceramics will examine problems and recommend experimental procedures. Potential contributors to a report elucidating the High Temperature Chemistry in Ceramics Processing are being contacted. The subcommittee on the Characterization of Carbonaceous Material and New Carbons met for the first time in 1993 and the ninth IUPAC High Temperature Material Chemistry Conference will be held in Penn State University in May 1997.

Potential new projects

A new task force will prepare a consistent set of Terminology of Vapor Disposition Techniques used to prepare ceramics, particularly including and emphasizing acronyms. The scope of a potential survey of the thermochemistry and Thermophysical Properties of Refractory Metal Carbides is being considered by a preliminary survey team.

Syllabi and bibliographies relevant to the teaching of High Temperature Chemistry at University are being solicited. And a potential effort to define Terminology of Silicon Nitride based Ceramics and Related Material is being defined in co-ordination with ISO and other interested groups. Evaluators, experimentalists, and computational chemists have been contacted regarding the Calculation of the Equilibrium Thermodynamic Properties of High Temperature Superconductors as a self-consistent set.

A proposed project on Sol-Gel and Polymer-Derived Ceramics, Glasses, and Ormocers would catalogue and classify, jointly with the Macromolecular Division, organic precursors, reaction mechanisms in polymerization and pyrolysis, and property modifications characteristic of organic additions to ceramics.

The next meeting of the Commission will be held with the 38th General Assembly in Guildford, UK, on 5–7 August 1995.

Gerd Rosenblatt

Critical Issues in Radiochemical Analysis

The Commission on Radiochemistry and Nuclear Techniques (V.7) met in April before the start of the third International Conference on Methods and Applications of Radioanalytical Chemistry in Kona, Hawaii. Most of the meeting was devoted to discussions of ongoing projects, new projects and strategic planning for the next few years. Many of these efforts have a distinct environmental flavour to them.

Professor Eiliv Steinnes (Norway) noted that he will soon complete a project on nuclear methods in environmental speciation. Professor Yongjun Zhu (China) expects a revised version of 'Critical Evaluation of Liquid Scintillation Spectrometry for Determination of α-emitting Nuclides in Environmental Samples' to be available before the Guildford IUPAC meeting. A group of authors from Russia represented by Professor Vladimir Kolotov anticipates that a project on low activation materials for fusion technology should be completed in 1996.

Several imminent proposals and revisions to previous proposals were discussed and Professor Andrzej Plønka (Poland) noted that numerous topics in radiation chemistry worthy of consideration by the Commission exist. Professor Yuanfang Liu (China), Chairman of the Commission, agreed that the unintentional disregard of this field needs to be remedied the future.

There was also discussion on some issues raised in a farewell communication from retired Commission Secretary Professor Hans Von Gunten (Switzerland). The important and complex issue of analysis associated with nuclear waste is in dire need of attention. Several categories of projects immediately came to mind. As a consequence of these discussions, Professor Zhu will explore chemical analysis in 'pretreatment' aspects of nuclear waste storage; Professor Plønka will begin to look into 'radiation chemistry of wastes'; two other major related topics, 'transmutation of actinides' and 'transmutation of fission products', need attention and expert participants will be sought.

Finally, stimulated by comments from Professor Von Gunten, there was a strong consensus that a serious manpower crisis in the field of radiochemistry is developing globally. It is manifested by a shortage of academic positions for young scientist with expertise in radiochemistry which will result in the disappearance of this resource for research and training in the not too distant future, just when its need will become crucial.

The next meeting of the Commission will be held in Guildford, UK on 5–7 August 1995

Paul, J. Karol

News & Views

Names and addresses

Full details (names, addresses, telephone/telex/fax numbers and e-mail) of officers of IUPAC bodies were published in *Chem. Intl.* 15 215–227 (1993). The IUPAC Secretariat has since been notified of the following changes:

Professor W. D. BUSSE (Secretary, Medicinal Chemistry Section) Bayer AG, Fachbereich Forschung, Geschäftsbereich Pharma. Postfach 101709, D-42096 Wuppertal, Germany. Tel.: + 49 (202) 368603; Fax.: +49 (202) 364471.

Dr Erich DORN (Chairman, Commission on Agrochemicals) Environmental Sciences Department, G836, AgrEvo, D-65926 Frankfurt am Main, Germany.

Dr René-Paul MARTIN (Chairman, Committee on Chemistry and Industry) Cabinet du Ministre de l´Education Nationale, 110 rue de Grenelle, F-75357, Paris 07, France. Tel.: +33 1 49 55 21 60; Fax.: +33 1 49 55 39 06.

Daniel MICHELET (Secretary, Committee on Chemistry and Industry) Rhône-Poulenc S.A., Direction Scientific, 25 quai Paul Doumer, F-92408 Courbevoie Cedex, France. Tel.: +33 1 4768 25 01; Fax.: +33 147 68 20 66.

Dr John R. MOODY (Chairman, Commission on Isotope Specific Measurements as References) National Institute of Standards & Technology, Chemistry Building, Room B206, Gaithersburg, MD 20899, USA. Tel.: + 1 (301) 975 4134; Fax.: +1 (301) 869 0413.

Professor Sjaark J. SLANINA (Chairman, Commission on Atmospheric Chemistry).

We regret to record to the deaths of:

Dr J. M. Barnett, Argentina (25 October 1993) – Coordinator of international relations of Associación Química Argentina with IUPAC (1979–93)

Dr M. A. Crivelli, Argentina (28 June 1993) – Bureau (1975–79)

Professor A. Silberberg, Israel (12 September 1993) – Macromolecular Division Committee (1968–89)

Professor F. Farina, Spain (3 June 1994) – Commission on Nomenclature of Organic Chemistry (1989-94)

Professor H. J. Emeléus, UK (2 December 1993) – President of Inorganic Chemistry Division (1959–63)/ Member of Division Committee (1955–59)

Professor L. Meites, USA (17 June 1993) – Commission on Electroanalytical Chemistry (1965–81)

Report from the XIV Chemistry Conference held in Cuba

The XIV Chemistry Conference sponsored by Universidad de Oriente (Santiago de Cuba, Cuba) and Universidad Autonoma Metropolinatana de Mexico (Mexico, D.F.) was held in Cuba on 25–27 May 1994. About 240 people participated in the sessions from three countries (Cuba, Mexico and USA).

Some 190 posters were presented, most focusing on the following topics: Organic, Analytical, Environmental and Chemical Education.

The opening lecture was delivered by Dr Alberto Nunez Sellez (Head of the Chemistry-Pharmacy Institute in Cuba and IUPAC national secretary). His lecture focused on the synthesis of the new molecules for use in pharmacy and the developing process involved in the validation of drugs for the market.

Other lectures looked at chemistry, the leaching process of Ni and Co in Cuba's plants, chemical sensors, biomaterials and Raman's spectroscopy.

Three round tables focused on the trends in teaching of general chemistry to first-year students at university; use and treatment of ligand effluent produced by a nickel factory in Cuba; and industrial biotechnology. Two workshops on thermal analysis and the determination of vitamins from B complex were developed.

In the closing ceremony the Dean of the Natural and Mathematics Faculty invited all the participants to meet again in Santiago de Cuba city.

Appointments

Dr René-Paul Martin of the Cabinet du Ministre de L´Education Nationale of France has been appointed Chairman of the Committee on Chemistry in Industry (1994–97) succeeding Professor Fischli. Daniel Michelet of Rhône-Poulenc succeeds Dr Martin as Secretary of the same Committee (1994–1997). Full details of their addresses are given below.

Affiliate Affairs

Information for affiliates

IUPAC publications

Affiliates are entitled to a 25% reduction and in some cases a 40% reduction on the cost of IUPAC publications except the scientific journal *Pure and Applied Chemistry*. A leaflet detailing IUPAC books currently available from Blackwell Scientific Publications has recently been distributed by the publishers to all *CI* readers. Further copies may be obtained from the IUPAC Secretariat.

How to contact commissions

IUPAC affiliates are entitled to communicate directly on scientific matters with the officers of IUPAC commissions. A full list of names and addresses of all commission officers for 1994–95 was published in the November 1993 issue of *CI*.

IUPAC-sponsored conferences

If you are interested in attending a conference please apply directly to the conference organizers for the conference circulars and registration forms. An updated list of names and addresses of the organizers of all future IUPAC sponsored conferences is given in the 'Conference Calendar' published in each issue of *CI*.

Ties and scarves

IUPAC ties and scarves may be purchased from the IUPAC Secretariat by applying to the Affiliate Affairs Secretary. The colours for both are *either* maroon *or* navy (dark) blue. The ties cost USD 14.00/GBP 7.00 each and the scarves USD 12.00/GBP 6.00 (including postage and packing).

Please use the form (or a photocopy of it) published on page 24 of the January 1994 issue of *CI*. Alternatively please write to the Affiliate Affairs Secretary with your order stating the colour you require. A cheque made payable to IUPAC for the appropriate amount should be enclosed with your order.

IUPAC poster

Copies of an IUPAC poster are available **free of charge** to affiliates and members of IUPAC's commissions and committees. The poster is printed in maroon and black on a white background and is approximately 42 × 59 cm in size.

IUPAC welcomes any publicity you can give to its activities. If you would like to display one or more copies of the poster in your department or elsewhere please write to the Affiliate Affairs Secretary stating your name and address and how many copies of the poster you wish to receive.

Address of IUPAC Secretariat

Please use the following address for all communications directed to the IUPAC Affiliate Affairs Secretary. If your are submitting a letter for publication in *Chemistry International* (*CI*), please indicate that the letter is 'Submitted for publication in *CI*.'

Affiliate Affairs Secretary, IUPAC Secretariat, Bank Court Chambers, 2–3 Pound Way, Templars Square
Cowley, Oxford OX4 3YF, UK.
Tel: +44 (865) 747744; Fax: +44 (865) 747510
E-mail: iupac@vax.oxford.ac.uk

Affiliate reduction of conference registration fees

It is a condition of IUPAC sponsorship of a conference that IUPAC affiliates are entitled to a 10% reduction or 'own members' rate on the registration fee for scientific participants. This concession is usually, but not always, announced in the conference circulars and indicated on the registration form.

To receive this reduction an affiliate must declare on the conference registration form that (s)he is an affiliate. Alternatively the affiliate should apply in writing to the conference organizer for this reduction stating that (s)he is an affiliate. Conference organizers may check with the IUPAC Secretariat that applicants for this reduction are currently registered as affiliates.

If an application for this reduction is refused, an affiliate should immediately notify the Affiliate Affairs Secretary and, if possible, forward copies of documentary evidence of this refusal.

Have you received your affiliate documents?

Every affiliate receiving a copy of the May 1994 issue of *CI* should have found, inserted in the magazine, a white envelope addressed to affiliates. The envelope contained the following documents:

- a letter from the IUPAC Affiliate Affairs Secretary;
- an IUPAC affiliate membership card valid until May 1995;
- an IUPAC affiliate membership certificate;
- an IUPAC affiliate membership registration form to be completed and returned to the IUPAC Secretariat before October 31st, 1994.

If your copy of the magazine did not contain this package of documents *and* you are a registered affiliate for 1994, then please inform the Affiliate Affairs Secretary at the IUPAC Secretariat. Replacement documents will be sent to you.

Partners in Chemical Education York, UK 28 August– 2 September 1995

IUPAC
SPONSORED

Partners in Chemical Education: the International Conference on Industry–Education Initiatives in Chemistry will be held from 28 August to 2 September 1995, at the University of York, York, UK.

The conference will bring together concerned industrialists and teachers from higher education, secondary and primary schools, and education decision makers. Its aim is to evaluate and encourage good practice – and discuss issues – of industry–education world-wide.

There will be one keynote address each day but much time will be spent in small groups, in workshops and seminars. workshops will be sessions actively involving participants in experiencing current successful practice in industry–-education links at all levels of education. In each symposium, there will be two or three short presentations centred on a common theme followed by a discussion. In both workshops and seminars, there will be a true international flavour.

The conference language is English. The expected registration fee is US$340 ($260 for IUPAC affiliates). Accommodation and meals on the campus will be approximately US$300.

Historic York holds many delights.

There will be a full social programme for participants and accompanying persons. York, founded some 2000 years ago, is famous for its Roman, Viking, Norman, Medieval and Georgian heritage. The walled city is dominated by York Minster, one of the largest and finest Gothic cathedrals in the world. Near York lies much beautiful scenery and many historic sites.

International Conference on the Applications of the Mossbauer Effect Rimini, Italy 10–16 September 1995

IUPAC
SPONSORED

The 5th ICAME (European conference) will be held in Rimini, Italy, on 10–16 September 1995.

The symposium aims to gather scientists working on Mossbauer spectroscopy (Nuclear Gamma Resonance Spectroscopy) to discuss recent problems in the following fields:

- Chemical structure and bonding
- Physical metallurgy and material science
- Magnetism and magnetic materials
- Amorphous, quasicrystalline and nanocrystalline materials
- Superconductors
- Semiconductors
- Surfaces, thin films and coatings, multilayers
- Interfaces, corrosion, catalysis
- Mineralogy, geology and archaeology
- Biology and medical applications
- Synchrotron radiation studies, gamma optics
- Theory and methodology
- Industrial applications

The conference will include invited talks and submitted contributions. Poster session will be held.

The registration fee before June 1, 1995, will be 500 000 Lire; after this date it will be 650 000 Lire. The fee for accompanying persons will be 250 000 Lire before June 1, 1995, and

The beautiful campus of York University, UK.

In Rimini is found possibly the oldest Roman arch.

350 000 Lire after this date. For graduate students and young researchers (born after 1967) the fee is 250 000 Lire. IUPAC affiliate members are entitled to a 10% reduction. An accompanying persons programme, as well as excursions during the Conference, will also be arranged.

The Conference will be held at the five-star Grand Hotel, Rimini, but reservations in neighbouring smaller hotels at reasonable prices will be also possible.

The venue is a small town, watering place of Emilia Romagna; it has a robust cheerfulness, algae-free sea and safe beaches. Local sites include the Malatesta Temple (15th century clock tower), the 27 BC Arch of Sigismondo and the elegant Bridge of Tiberius. Capital of the Adriatic Riviera, Rimini has excellent rail links with the most important Italian cities and the rest of Europe, and had an international airport. A modern motorway network provides rapid access from both north and south.

ICC Jubilee Conference – The Role of Cereals in Future Nutrition

The ICC is the pre-eminent international association in cereal science and technology, committed to international co-operation through dissemination information and developing standard methods for the well-being of all people. It will celebrate its 40th anniversary in 1995 and its Jubilee Conference – The Role of Cereals in Future Nutrition – will be held in Vienna on 22–25 May 1995. It will take Carbohydrates as its main theme and the topics it will look at include:

- Raw material processing;
- Analytical methods;
- Nutritional aspects.

A joint symposium with the American Association of Cereal Chemists is planned, together with a joint symposium with the Federation of European Nutrition Societies.

For more information. please contact: ICC Jubilee Conference, c/o ICC Secretariat General, PO Box 77, Wienerstrasse 22A, A-2320 Schwechat, Vienna, Austria. Tel.: +43 1 707 72 02; Fax.: +43 1 707 72 04

The Sixth Asian Chemical Congress

The sixth Asian Chemical Congress will be held in Manila, the Philippines on 22–26 May 1995. It will be held simultaneously with the 11th Philippine Chemistry Congress and the 3rd Regional Food Analysis Workshop. The theme of the Congress is: 'Fast-Track Sustainable Regional Development: Linking Government. Industry, and Academe'. The Congress is being sponsored and organized by the Integrated Chemists of the Philippines, Philippine Federation of Chemistry Societies, Department of Science and Technology and the Chemical Industries Association of the Philippines, under the auspices of the Federation of Asian Chemical Societies.

The Congress will provide a venue for the exchange of ideas among chemists in order to fast-track regional development through chemistry. Likewise, this will strengthen the linkages among chemists in governmental, industrial and academic sectors for sustainable economic growth. Scientists are invited to provide an overview of research fields in chemistry of general interest an and of relevance to the theme.

For further information contact: 6 ACC '95 Secretariat, c/o Philippine Federation of Chemistry Societies, U.P. NSRI Bldg, Dilimary, Quezon City 1101, Philippines. Tel.: +63 2 97 57 36; Fax.: +63 2 99 68 68.

Conference Calendar

1994

Physical organic chemistry

28 August – 2 September
12th International Conference on Physical Organic Chemistry.
Padova, Italy.
Prof. F. Di Furia, Department of Organic Chemistry, Via Marzolo 1, I-35131 Padova, Italy. Tel: +39 (49) 831297. Fax: +39 (49) 831222. E-mail POC12@CHOROO.UNIPD.IT

Macrocyclic ligands

29 August – 1 September
2nd International Symposium on Macrocyclic Ligands for the Design of New Materials.
Buenos Aires, Argentina.
Dr Angela F. Danil de Namor, Department of Chemistry, University of Surrey, Guildford, Surrey GU2 5XH. Tel: +44 (483) 509581. Fax: +44 (483) 300803/571035.

Liquid crystal polymers

6–9 September
International Conference on Liquid Crystal Polymers. Beijing, China.
Prof. Xibai Qiu, Chinese Chemical Society, PO Box 2709, Beijing 100080, China.

Thermal analysis and calorimetry

11–16 September
6th European Symposium on Thermal Analysis and Calorimetry (ESTAC).
Grado, Italy.
ESTAC 6 – Prof. A. Cesàro, Dip. BBCM, University of Trieste, I-34127 Trieste, Italy. Tel: +39 (40) 6763684. Fax: +39 (40) 6763691. E-mail: CESARO@UNIV.TRIESTE.IT.

Geotoxicology

18–22 September
International Conference on Geotoxicology: Mutagens and Clastogens in the Environment.
Oxford, UK.
Dr Katherine J. Kaye, School of Geography, University of Oxford, Mansfield Road, Oxford, OX1 3TB, UK. Tel: +44 (865) 271929. Fax: +44 (865) 271929.

Medicinal chemistry

19–23 September
13th International Symposium on Medicinal Chemistry.
Paris, France.
Administrative Secretariat, Convergences – ISMC '94, 120 avenue Gambetta, 75020 Paris, France. Fax: +33 (1) 40310165. Telex: 216911F.

Molecular mobility and order in polymer systems

3–6 October
International Symposium on Molecular Mobility and Order in Polymer Systems.
St. Petersburg, Russia.
Irina Kovalenko, Symposium Co-ordinator, Institute of Macromolecular Compounds, Russian Academy of Sciences, Bolshoy pr. 31, St. Petersburg, 199004 Russia. E-mail: ADAR@MACRO.LGU.SPB.SU.

Functional & high performance polymers

14–16 November 1994
International Symposium on Functional & High Performance Polymers.
Taipei, Taiwan, China.
IUPAC International Polymer Symposium, Taipei (IPST) Secretariat, Prof. Ging-Ho Hsiue, Department of Chemical Engineering, National Tsing Hue University, Hsinchu, Taiwan 300, China. Fax: +886 (35) 726825. E-mail: ipst@nthu.edu.tw

Organic synthesis

11–16 December
10th International Conference on Organic Synthesis.
Bangalore, India.
Prof. G. S. R. Subba Rao, (Secretary, ICOS-10), Department of Organic Chemistry, Indian Institute of Science, Bangalore 560 012, India.

1995

Polymer morphology and electrical properties

5–7 July
International Symposium on Polymer Morphology and Electrical Properties.
Lodz, Poland.
Prof. M. Kryszewski, Centre of Molecular & Macromolecular Studies, Polish Academy of Sciences, Sienkiewicza 112, 90–363 Lodz, Poland.

Analytical chemistry

9–15 July
SAC 95: International Conference on Analytical Chemistry.
Hull, UK.
Prof. A. Townshend, School of Chemistry, University of Hull, Hull HU6 7RX, UK. Tel: +44 (482) 465027. Fax: +44 (482) 466410.

How to apply for IUPAC sponsorship

To apply for IUPAC sponsorship, conference organizers should write to the IUPAC Secretariat (see inside back cover for address) requesting an Advanced Information Questionnaire (AIQ). Completed AIQs should be returned to the Secretariat preferably 2 YEARS and at least 12 months before the conference. Late applications will not be considered. Further information on granting of IUPAC sponsorship was published in *Chem. Intl.* **14**, 203 (1992).

Toxicology and clinical chemistry of metals

10–13 July
5th COMTOX Symposium on Toxicology and Clinical Chemistry of Metals. Vancouver, BC, Canada.
Prof. F. W. Sunderman, Jr., Departments of Laboratory Medicine and Pharmacology, University of Connecticut Medical School, Post Office Box 1292, Farmington, Connecticut 06034–1292, USA. Tel: +1 (203) 792328. Fax: +1 (203) 6792154.

High swelling gels

10–14 July
36th Microsymposium on Macromolecules – High Swelling Gels. Prague, Czech Republic.
Prof. B. Valter, Institute of Macromolecular Chemistry, Academy of Sciences of the Czech Republic, Heyrovského nám 2, 162 06 Prague 6-Petriny, Czech Republic. Tel: +42 (2) 360317. Fax: +42 (2) 367981.

Organometallic chemistry directed toward organic synthesis

6–10 August
8th IUPAC Symposium on Organometallic Chemistry directed toward Organic Synthesis (OMCOS-8). Santa Barbara, California, USA.
Prof. B. H. Lipshutz, Department of Chemistry, University of California, Santa Barbara, California 93106–9510, USA.

Heterocyclic chemistry

6–11 August
15th International Congress of Heterocyclic Chemistry. Taipei, Taiwan, China.
Prof. Chin-Kang Sha, Department of Chemistry, National Tsing Hua University, Hsinchu 300, Taiwan, China.

35th IUPAC Congress

14–19 August
35th IUPAC Congress. Istanbul, Turkey.
Prof. Yüksel Inel, Chemistry Department, Bogaziç University, P.K.2 Bebek 80815, Istanbul, Turkey. Tel: +90 (1) 2631500 or 2631540, ext. 1619 (direct) or ext. 1610 (secretary). Fax: +90 (1) 2659778 or 2656357. E-mail: INEL@TRBOUN

Plasma chemistry

21–25 August
12th International Symposium on Plasma Chemistry. Minnesota, Minneapolis, USA.
Prof. J. Heberlein, Department of Mechanical Engineering, University of Minnesota, Minneapolis, MN 55455, USA.

Industry – education initiatives in chemistry

28 August – 2 September
International Symposium on Industry – Education Initiatives in Chemistry. York, UK.
Prof. D. J. Waddington, Department of Chemistry, University of York, Heslington, York, YO1 5DD, UK.

Medicinal chemistry

3–8 September
AFMC International Medicinal Chemistry Symposium (AIMECS 95). Tokyo, Japan.
Dr N. Koga, Daiichi Pharmaceutical Co. Ltd., Nihonbashi 3-14-10, 3-chome, Chuo-ku, Tokyo 103, Japan.

Ionic polymerization

4–8 September
1st International Symposium on Ionic Polymerization. Istanbul, Turkey.
IUPAC International Symposium on Ionic Polymerization, c/o Prof. Y. Yagci, Istanbul Technical University, Faculty of Science, Department of Chemistry, Maslak 80626, Istanbul, Turkey.

Applications of the Mössbauer effect

10–16 September
International Conference on the Applications of the Mössbauer Effect (ICAME-95). Rimini, Italy.
Prof. I. Ortalli, University of Parma, Istituto di Scienze Fisiche, Via M. D'Azeglio, 85, 43100 – Parma, Italy.

1996

Coordination chemistry

18–23 August
31st International Conference on Coordination Chemistry. Vancouver, Canada.
Prof. C. Orvig, Department of Chemistry, University of British Colombia, 2036 Main Mall, Vancouver, BC V6T 1Z1, Canada.

Physical organic chemistry

25–29 August
13th International Conference on Physical Organic Chemistry. Seoul, Republic of Korea.
Prof. J. Suh, Department of Chemistry, Seoul National University, Seoul 151–742, Republic of Korea. Tel: +82 (2) 8805456. Fax: +82 (2) 8891568.

Chemistry of natural products

September
20th IUPAC Symposium on the Chemistry of Natural Products. Chicago, USA.
Dr R. J. Pariza, Manager, D-54P, Building A-1, Abbott Laboratories, North Chicago, IL 60064–4000, USA.

Visas

It is a condition of sponsorship that organizers of meetings under the auspices of IUPAC, in considering the locations of such meetings, should take all possible steps to ensure the freedom of all bona fide chemists from throughout the world to attend irrespective of race, religion, or political philosophy.

IUPAC sponsorship implies that entry visas will be granted to all bona fide chemists provided application is made not less than three months in advance. If a visa is not granted one month before the meeting the IUPAC Secretariat should be notified without delay by the applicant.

Catalysis Letters

Editors-in-Chief:
Gabor A. Somorjai, Department of Chemistry, University of California, Berkeley, CA 94720, USA
Sir John Meurig Thomas, Davy Faraday Research Laboratory, The Royal Institution of Great Britain
21Albemarle Street, London, WIX 4BS, United Kingdom

Recently published: Volume 20, No. III-IV, 1993
K. Coulter and D.W. Goodman, The role of carbon dioxide in the oxidative dimerization of methane over Li/ MgO
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The International Union of Pure and Applied Chemistry (IUPAC), formed in 1919, is a voluntary non-governmental, non-profit association of organizations, each of which represents the chemists of a member country.

Its objectives are:

- to promote continuing co-operation among the chemists of the member countries;
- to study topics of international importance to pure and applied chemistry which need regulation, standardization, or codification;
- to co-operate with other international organizations which deal with topics of a chemical nature;
- to contribute to the advancement of pure and applied chemistry in all its aspects.

The membership of IUPAC presently comprises 40 countries, each represented by a national organization, such as an academy of science or research council.

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0193-6484(199409)16:5:1-0

Printed in England by Bocardo Press

ISSN 0193-6484

Chemistry International

The news magazine of the International Union of Pure and Applied Chemistry (IUPAC)

IUPAC

1994, Vol. 16, No. 6 (November)

Blackwell Scientific Publications

Chemistry International

The news magazine of the International Union of Pure and Applied Chemistry (IUPAC)

ACTING EDITOR: Michael Ward
SECRETARIAL ASSISTANTS: Mary Patterson and Katie Smith
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Six issues of *Chemistry International* will be published bimonthly in 1994. The 1994 subscription rate including postage is GBP 58.00 (UK and overseas except North America) or USD 91.00 (US and Canada). The individual subscription rate is GBP 27.50 (UK and overseas except North America) or USD 39.50 (US and Canada). Microfiche subscriptions are available simultaneously with the printed edition, and microfilm at the end of the subscription year. Subscription orders may be placed directly with IUPAC's official publisher, Blackwell Scientific Publications Ltd, PO Box 88, Oxford, UK.

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Despatch. The news magazine is despatched within Europe by surface mail, to other continents by various forms of air-speeded delivery: to the US* by air freight for forwarding by second-class post, to India by air freight for guaranteeed local delivery, and to all other countries by Accelerated Surface Post.

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*Second-class postage paid at Rahway, NJ. Post Master, send address changes to *Chemistry International*, c/o Mercury Airfreight International Inc., 2223 Randolf Avenue, Avenel, NJ 07001, USA.

Front cover: The Ayasofya Museum in Istanbul, the city in which the 35th IUPAC Congress will be held.

International Union of Pure and Applied Chemistry

The Istanbul Congress

The 35th IUPAC Congress, organized by the Turkish Chemical Society, will be held in Istanbul, Turkey, Monday 14th to Saturday 19th August 1995. The scientific programme will be devoted to six areas of chemistry. The official language of the Congress will be English. No facilities for translation or interpretation will be available.

Situated on the shores of the Bosphorus, where the waters of the Black Sea mingle with the Sea of Marmara and the famous Golden Horn, Istanbul is the only city in the world to be built on two continents, where Eastern and Western civilizations meet. Indeed, contemporary western ways exist together with the traditional. Modern buildings and art forms appear alongside with classical Turkish, Byzantine and Roman masterpieces.

Istanbul is the largest city in Turkey with some 15 million inhabitants. Yet with its expansion it has not lost its charm. In the old city, that has expanded beyond the city walls since the end of the 19th century, most of the main roads and squares are still the same as they were in the 5th and 6th centuries. Most of the important buildings – palaces, places of worship – of the Byzantine and Ottoman periods and even some of those of the Roman period still stand intact. Most of the narrow streets and peculiar apartment houses of Galata and Beyoglu, where the Christian population of the city used to dwell, still look as they did at the turn of the century, and the European architectural style of some 80–90 years ago may be observed in the part where the European embassies can be found.

The Ayasofya Museum, a 6th-century building, is one of the most outstanding architectural achievements of all time and contains many lovely Byzantine mosaics. Other favourite attractions for visitors are the Dolmabhaçe Palace on the Bosphorus, which is regarded as the richest palace in the world, the olfactory and visual experience of the Spice Bazaar, the Galata Tower, the Archaeological Museum, and the Turkish and Islamic Arts Museum. An Istanbul evening tour with belly dancing and folk shows is regarded as a night straight from the 1001 nights. The average air and water temperatures in Istanbul at the time of the Congress are both 23 °C.

Top left: Antalya, Yivili Minaret; Bottom left: Kaunos, rock tombs; Right: Denizli, Parmaukkale-lime terraces

Turkish Chemical Society

The IUPAC affiliate membership programme in Turkey is operated by the Turkish Chemical Society (TCS), which was founded in 1919 by three students just about to graduate as chemists from the Faculty of Science of Istanbul University. TCS is a nonprofit scientific and professional organization which represents Turkish chemists nationwide as well as internationally.

Organization

The General Council of the TCS, consisting of all members, meets once a year for the purpose of electing the officers of the Executive Committee, which consists of nine members: a president, a vice-president, a general secretary, an accountant, a treasurer, and four members. TCS also has an auditing committee and a discipline committee. The society has representatives in all Turkish universities.

Membership

Any senior student of chemistry in an institution of higher education may become a ‘candidate member’. This may turn into full membership as soon as he or she graduates. In addition, honorary membership, membership of distinction and institutional memberships are possible. Today, TCS has about 1600 members and 140 candidate members. Its annual membership fee of about $10 for full members is the society’s only source of income.

Purpose and activities

TCS aims to be a source of information, both for chemists and for the public in general, about all the issues concerning the science of chemistry and its applications. It co-operates with institutions of chemical education, communicates and protects the rights of chemists, supports professional advancement in all fields of chemistry, fosters co-operation between chemical professionals, organizes meetings, conferences, seminars, congresses and all kinds of scientific events, gives financial support to chemistry students and helps them find jobs or positions for professional training.

TCS also establishes and maintains relations with other similar institutions. It has been a national adhering organization of the IUPAC since 1958, and a member of the Federation of European Chemical Societies since 1985. In addition, it is a member of the International Organization for the Chemical Sciences in Development and the International Organization of Balkan Chemistry Days. Publications of TCS include a monthly newsletter and the quarterly journal *Chemistry and Industry*, as well as monographs.

Scientific programme

The scientific programme will be devoted to the following six areas of chemistry:

Section 1. Human Needs Through Chemistry

Environment

- Atmospheric pollution, acid rain, the greenhouse effect
- Clean water
- Safe disposal of chemical and nuclear wastes
- Speciation in aquatic media
- Analytical quality and separations
- Biomarkers for chemical exposure
- Risk assessment
- Work environment
- Recycling

Food

- New techniques for food analysis
- Quality control in food science
- Food additives and food contaminants
- Microbiology of foods
- Biotechnology, kinetic modelling in food science
- Photodegradation in foods

Energy

- Alternative energy sources
- Combustion
- Artificial photosynthetic and electrocatalytic techniques for converting solar energy to chemical energy
- Chemical and electrochemical energy storage systems
- Coal chemistry

Health

- Clinical chemistry and toxicology
- Drug and cancer research, chemotherapy
- Enzymes, vitamins, antibiotics and antivirals
- Tropical chemistry
- Standardization of measurements and communication

Section 2. Physical Chemistry – Chemical Change, Dynamics and Structure

- Fast chemical processes
- Energy transfer
- State-to-state chemistry

- Multiphoton and multiple photon excitation
- Mode-selective chemistry
- Theoretical calculations of reaction surfaces
- Chemical kinetics
- Molecular thermodynamics
- Computational chemistry
- Laser and molecular beams
- Corrosion and its prevention

Section 3. Organic Chemistry – Synthesis, Mechanisms and Natural Products

- Bio-organic chemistry, bio-electrochemistry
- Organometallic chemistry
- Physical organic chemistry, organic electrochemistry
- Organic photochemistry
- Biosynthesis
- Identification of natural products
- Natural products with potential pharmacological activities and characterization

Section 4. Polymer Science and High Technology Materials

- New polymerization methods
- Structure and properties of macromolecules
- Solution properties of macromolecules
- Engineering polymers and high performance materials
- Polymeric blends and networks
- Liquid crystalline polymers
- Novel polymers having biological significance

Section 5. Analytical Chemistry and Instrumentation

- Computer based analytical methods
- Electroanalytical methods
- Flame, electrothermal, plasma and other techniques for atomic spectroscopy
- Molecular spectroscopy, UV, VIS, IR, NMR, ESR, MS, luminescence and other novel techniques
- Analytical separations and chromatography
- Analytical separations in clinical pharmaceutical fields, analytical automation
- Optical, electrochemical, acoustic, biological and other sensors and probes
- Chemometrics, enzymatic techniques, capillary electrophoresis, chiral separations, immunoanalysis
- Modern trends in surface analysis

Section 6. Inorganic Chemistry and Solid State

- Intermetallic compounds
- New advanced inorganic materials
- Co-ordination chemistry, electrochemistry of co-ordination compounds
- Bio-inorganic chemistry
- Inorganic photochemistry and photoelectrochemistry
- Organometallic and cluster chemistry
- Rare earth chemistry
- Optoelectronics, crystals, thin films
- Condensed phase chemistry
- Catalysts and related subjects
- Superconductors, semiconductors, organic conductors, solid state ionic conductors

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Sessions on these sections will take place both concurrently and sequentially. Contributions to all sessions are invited papers dealing with topics outside those of the sessions are also welcome. Contributed papers are accepted in the form of either oral or poster presentations which will carry equivalent scientific status in the programme and in the resulting publication. The deadline for submission of abstracts is 31 December 1994. Acceptance of contributions will be notified by 15 February 1995. An exhibition of scientific equipment, scientific books, chemicals, computers and software, laboratory computing and automation is being organized. Companies interested in participating should contact the Congress General Secretary.

A social programme, including a welcome cocktail, a reception, a farewell banquet, tour of the city, opening and closing ceremonies, and programme for accompanying persons will be available.

All correspondence concerning the 35th Congress should be addressed to: Professor A. R. Berkem, 35th IUPAC Congress, Halaskargazi Cad. No:53, D.8, 80230 Harbiye, Istanbul, Turkey. Tel: (90) (212) 240 7331. Fax: (90) (212) 231 7037.

Intergovernmental Forum on Chemical Safety

Executive heads of the International Labour Office (ILO), the United Nations Environment Programme (UNEP) and the World Health Organization, met up with representatives of 114 countries, governmental agencies and nongovernmental organizations, such as IUPAC, to establish mechanisms to promote environmentally sound and safe management of chemicals. The International Conference on Chemical Safety (ICCS) decided to establish the Intergovernmental Forum on Chemical Safety (IFCS).

Chemicals clearly have an important role in meeting the social and economic goals of the world community. There is, however, an increasing awareness of the potentially harmful impact on human health and the environment that adverse effects of chemicals may cause. Consequently, there is already a great deal of fruitful work being carried out at the national level, and by a great number of intergovernmental and nongovernmental organizations to promote chemical safety. Nevertheless, it has been increasingly recognized that a strengthened direct co-operation between all those concerned with the field of chemical safety would offer new opportunities to provide policy guidance, identify priorities and develop strategies in a co-ordinated and integrated manner, as well as providing the required political support and fostering an understanding of the issues. It was against this backdrop, and in response to an invitation from the United Nations Conference on Environment and Development (UNCED) Agenda 21 to further consider the establishment of an intergovernmental forum on chemical safety, that delegates to ICCS held in Stockholm, on 25–29 April 1994 decided to push ahead with the forum.

ICCS delegates also invited the executive heads of ILO, UNEP and WHO, as well as other governmental organizations that may have a hand in strengthening the International Programme on Chemical Safety (IPCS), to make the necessary interim and long term arrangements, for a cost-effective secretariat for the newly established IFCS. The ICCS recommended that an IFCS secretariat should be within, but functionally distinct from the IPCS secretariat, and that its work should not jeopardize the scientific and technical work carried out within the framework of IPCS. But the Director of IPCS, Dr M. Mercier, emphasized to delegates that the Forum is not meant to be a new institutional body but rather part of a mechanism for co-ordination of national and international work in the field of chemical safety.

IFCS terms of reference

ICCS delegates agreed that the new Forum is a noninstitutional arrangement whereby representatives of governments meet to consider, provide advice and make recommendations on aspects of chemical risk assessment and environmentally sound management of chemicals. Its purpose is to provide policy guidance with emphasis on regional and sub-regional co-operation, develop strategies in a co-ordinated and integrated manner and foster understanding of the issues, and to promote the required policy support needed to discharge these functions. Furthermore, it will seek

Second IUPAC–COCI workshop in chemical production was held in Yokohama, Japan on 31 May – 4 June 1993

Howard Worth, IUPAC/ WHO Liaison Officer

consensus amongst decision makers representing governments on the development of strategies for the implementation of Agenda 21, Chapter 19, which relates to the environmentally sound management of toxic chemicals including prevention of illegal international traffic in toxic and dangerous products, and will undertake periodic review of such strategies. It will endeavour to provide clear and consistent advice for cost-effective, integrated risk assessment and management of chemicals using environmentally sound and generally accepted principles, including advice on alternatives to banned or severely restricted chemicals.

The founders have identified a number of specific functions the forum will have. It shall, they say, be responsible for establishing priorities for co-operative action on chemical safety and will recommend concerted international strategies for the identifying hazards and chemicals risk assessment, particularly for developing countries. Risk reduction, risk communication and looking at occupational exposure will be key components of the strategy. It will try to foster international collaborative efforts and ensure that there is no unnecessary duplication of activities. This includes making recommendations for appropriate distribution of work among organizations and other bodies within and outside the United Nations system. Prevention is always better than cure, and the Forum will have a role in formulating national programmes and international co-operation for the prevention of, preparedness for, and response to chemical accidents including major industrial accidents. It will also promote the strengthening of programmes for the prevention of and response to poisoning by chemicals. Albert Fischli, who was representing the Union at ICCS in Stockholm offered the new Forum IUPAC's technical support.

Invitations to participate in the Forum as government participants will be sent to all member states of the UN, of its specialized agencies and of the International Atomic Energy Agency. It is anticipated that the governmental representatives will be senior officials concerned with chemical safety. Associate members of any of the specialized agencies, intergovernmental organizations with an interest in chemical safety and international nongovernmental organizations concerned with health, workers' interests, the environment, consumers and industry are also being invited to take part, although they will not have voting rights in the Forum. Delegates at ICCS elected that Sweden should provide the Forum presidency, China, Mali and Mexico should provide vice presidents, and the Russian Federation the rapporteur. It was decided that there will also be an intersessional group consisting of the Forum officials plus no more than 26 government participants elected by each session of the Forum. This grouping will meet between sessions and will provide feedback to participating organizations of the IPCS. The intersessional group may also make recommendations to the Forum, study special problems, and advise on the implementation of strategies and programmes as approved by the Forum.

Running costs

Estimates of the costs of running IFCS conferences range from USD36 800 to USD120 000 depending on the number of languages used and duration of the conferences. The lower estimate represents the cost of a four day meeting with three UN languages (English, French and Spanish) while the higher estimate is for a 5-day meeting with six UN languages (English, French, Spanish, Chinese, Arabic and Russian). The cost of a 3-day intersessional group meeting is estimated at USD25 800 to USD52 800, depending on the number of UN languages catered for. The cost of running a fully operational IFCS secretariat, from January 1997, is estimated at USD926 487. In the interim, between the establishment of IFCS in May 1994 until the second meeting of the Forum at the end of 1996, the core costs of the secretariat have been estimated at USD615 794, if some of the running costs are shared with the IPCS secretariat.

Future priorities and activities

ICCS delegates agreed broad priorities for action for the Forum. These priorities are very much in line with the objectives of UNCED Agenda 21 which consists of 6 programme areas:

- Expanding and accelerating international assessment of chemical risks;
- Harmonization of classification and labelling of chemicals;
- Information exchange on toxic chemicals and chemical risks;
- Establishment of risk reduction programmes;
- Strengthening of national capabilities and capacities for management of chemicals;
- Prevention of illegal international traffic in toxic and dangerous products.

Delegates urged all participants to co-operate to the fullest extent possible, particularly on a regional basis, in the effective implementation of the recommendations. Furthermore, it was also decided that a report on the progress made in implementing the above recommendations be presented to the next session of the Forum.

IFCS president Kerstin Niblaeus has written to all NGOs, including IUPAC, giving details of the progress so far made. A meeting of the Forum officers was arranged and is to be held in Stockholm on 6–7 October. The first meeting of the Intersessional Group is to be held in Bruges on 21–23 March 1995, at the invitation of the Government of Belgium, although details of the meeting and its agenda were not available as *Chemistry International* went to press. Niblaeus also revealed that a trust fund for the Forum has been established at WHO, and that the Forum is seeking financial support from Forum participants.

IUPAC–UNESCO–UNIDO training programme

Safety and environmental protection are high on the chemical industry agenda. IUPAC, which has a key role in the promotion of chemistry, is doing its bit. In collaboration with two United Nations agencies, UNESCO and UNIDO, IUPAC is involved in a joint training programme which provides safety and environmental protection experts from developing countries with the opportunity to receive extensive continuing education in their specialist field, as guests of selected companies. Three of the first fellows on the scheme report their experiences.

Accidents at Bhopal, India, in 1984 and Schweizerhalle, Switzerland, in 1986, put the spotlight on the chemical industry. Indeed, they have reinforced, within the industry itself, a concept of corporate responsibility and accountability. A number of initiatives – some voluntary, others based on new legislative requirements – emerged in the aftermath designed to improve the industry's safety record and reduce any detrimental impact its activities may have on the environment. Yet while industries in developed countries are introducing sophisticated safety measures covering operational, health and environmental aspects, in close interaction with governments and the public, the gap between North and South in safety education, research and implementation of technical measures is widening rapidly. With chemical production and consumption growing rapidly in the developing countries, the need to promote North–South interaction to facilitate the transfer of state-of-the-art knowledge on safety and environmental protection in chemical production is imperative.

Under Vice-President Professor Albert Fischli's careful gaze, IUPAC's Committee on Chemistry and Industry (COCI), has already organized two workshops on safety in chemical production. The first was held in Basel, Switzerland, in 1990 and the second in Yokohama, Japan, in 1993. A third workshop is scheduled to take place in the UN building in New York in 1995. The Union, UNIDO and UNESCO have also launched a joint training programme to ensure that the knowledge transfer will take place. Under the first round of the scheme, four scientists from China, India, Poland and Thailand have received in-depth training at IUPAC company associates in Germany, Sweden and Switzerland.

According to Fischli, the training programmes have a clear practical value. 'The goal of the programme is to train people from Third World countries and make them more aware of safety and environmental protection in the chemical industry. Congresses and conferences are of strictly limited value since they are concerned mainly with theory. What is more useful is to have specialists, centres and institutes all over the world working on environmental protection problems.' Safety and environmental specialists from developing countries are given real hands-on experience by observing how companies in the developed world conduct themselves. 'During their stay, they can get to know the day-to-day routine of the

The main plant and head office of Bayer AG in Leverkeusen, Germany.

Dr Marisa Arunchaiya, head of the analytical laboratory of the Ministry for Science and the Environment in Bangkok, Thailand

relevant specialist departments and see behind the scenes, before returning to their own countries to put what they have learned into practice.'

Trainees go through a two part selection. First, the national organizations of UNESCO and UNIDO conduct a kind of prescreening to allow them to propose a short-list of candidates. Several points are considered during the prescreening phase: the candidate's *curriculum vitae* and level of experience. 'The candidate's job must bring him or her into contact with the realm of safety and environmental protection in chemical production, and they must have a good educational background and a knowledge of English,' Fischli adds. The international bodies then use the short-list to make their final selections. When searching for suitable host companies, the requirements of firms taking part and the personal preferences of candidates are taken into account.

UNESCO and UNIDO pay the travel costs for the fellows, while the host companies are responsible for funding the actual stay. Although the host firms are under no obligation to provide ongoing support beyond the duration of the training programme, Fischli does not believe the relationship between the fellows and host companies finishes at the end of the stay. 'I am sure that candidates take advantage of the opportunity to make contacts during their stay. Then, after returning home, they have an open channel to experts if technical problems arise.' UNIDO is currently developing a programme, called a *Global Network of Safety*, which involves the building of training centres for safety and environmental protection in developing countries. There are already concrete plans for such centres in India, Indonesia and Thailand. It is intended to recruit people who have taken part in the training programme as teachers for the training centre.

Thai scientist develops awareness and vigilance

One of the first beneficiaries of the training fellowships was Dr Marisa Arunchaiya, who heads the analytical laboratory of the Thai Ministry for Science and the Environment in Bangkok. Her work there is mainly concerned with the study of industrial chemicals. Arunchaiya recently completed an intensive four week training programme at Roche Basel, where she was the guest of the Department of Safety and Environmental Protection. Developed by Roche's Dr Louis Schnurrenberger. Arunchaiya became very familiar with many aspects of company's health, safety and environment activities, including plant safety, the incident task force and technical safety, the environmental protection laboratories, and the units for safety and health safeguards at the workplace. Commenting on Arunchaiya's contribution, Schnurrenberger said: 'Dr Arunchaiya demonstrated her eagerness to learn by following up particular questions and setting priorities of her own. She was especially interested in the waste recycling and waste analysis units, risk analysis in chemical production and industrial hygiene, as well as gaining a deeper insight into the

Prof. Albert E. Fischli (IUPAC Vice-President, left) and Dr Louis Schnurrenberger both from F. Hoffmann-La Roche Ltd. Basel, Switzerland in front of one of the company buildings

filed of Good Laboratory Practices (GLP).' The introduction of GLP, an internationally accepted standard for determining the properties of chemical substances, is currently high on the agenda in Thailand. Putting the guidelines into practice, however, is still fraught with problems.

Dr Arunchaiya says that her stay in Basel more than lived up to expectations. 'I have become more aware of, and knowledgeable about, the environmental protection and safety problems we face in Thailand. For example, I have realized that, to solve certain problems, it generally needs several well co-ordinated organizations. I also got ideas and inspiration about where to start making changes. I hope that everything I learned during this visit will contribute to progress in this field in Thailand.'

Dr Schnurrenberger is also very upbeat in his assessment of the project. 'Marisa Arunchaiya was highly competent and already familiar with some aspects of the subject. In my view, that is the key to getting the most out of an educational visit of this nature. Otherwise, we could have done little more than convey the briefest of overviews. Dr Arunchaiya was able to gain a valuable insight into the work of our Safety and Environmental Protection Department and take comprehensive documentation back with her. She made numerous contacts and saw, for example, how important it is for industry and the authorities to co-operate closely.' But the flow of information is not just one-way. Schnurrenberger says he and his colleagues also benefited from Dr Arunchaiya's visit. 'We have had a glimpse into the world of industry in Thailand. For instance, we were surprised to learn how modern the analytical laboratories in Thailand are, though there are often problems getting equipment properly serviced.'

Bayer applauds training programme

IUPAC Company Associate, Bayer, was one of the first companies to declare its willingness to participate in the IUPAC/UNIDO/UNESCO training initiative. As soon as the scheme was announced Bayer was offering a three week training period for a young safety specialist in the Plant Safety and Technical Inspection Department (IN-ATUE) of its Leverkusen plant. Bayer took on board Liu Xunfeng, a 29-year-old chemical engineer with Shanghai Petrochemical Company, the largest chemical manufacturer in the People's Republic of China.

Mr Liu's training at Bayer centred on the work of the Plant and Process Safety sub-department, which provides its services to the production departments of all of Bayer's 21 business groups. According to Dr Volker Pilz, director of IN-ATUE, the programme devised for Mr Liu gave him an insight into the various practical tasks associated with this broad-ranging field. he was able to take part in tests and experiments and also to discuss the theoretical aspects with Bayer experts. The main emphasis was on plant and process safety, technical inspection and materials engineering. In addition, visits were arranged to Bayer's waste management centre and the occupational safety and fire departments.

At the end of his visit, Mr Liu said he was very satisfied with the comprehensive programme, which had greatly increased his knowledge. Dr Pilz, in turn, praised the great interest shown by Mr Liu and his technical expertise. Dr Pilz added that Mr Liu's excellent command of English made it possible to co-operate closely in what is a highly complex and specialized field. Dr Pilz said he was sure that Mr Liu will be able to put the knowledge he has gained at Bayer to immediate and beneficial use back home in the PRC. From Bayer's point of view its involvement in the IUPAC–UNESCO–UNIDO training programme has been a great success.

Mr Liu Xungfeng, Chemical engineer from SPC, Shanghai, in front of cathedral and railway bridge in the City of Cologne, Germany.

Dust explosion know-how will be a great help

Polish chemist Tadeusz Piotrowski says he is returning home from his stay with Ciba in Basel with some excellent impressions and ideas that he intends to apply in his work. Piotrowski has just completed a one month training and work experience visit with Ciba's Safety and Environmental Protection department in Basel. Though he thinks the time went by far too quickly, he describes his hands-on look inside a modern production facility as very rewarding.

Piotrowski, who works at a public institute in Warsaw, was in Basel to learn about the latest explosion prevention and process safety techniques. For Kaspar Eigenmann, head of Central Safety and Environmental Protection Services at Ciba, it was only natural for the company to become involved in the programme. Martin Glor, another of the company's S&E experts had most of the responsibility for working out a schedule that would offer Piotrowski more than just a brief look at Ciba's prevention and protection systems. 'Among other things, in the short time available Mr Piotrowski lent a hand in our S&E lab,' Glor added. 'Afterwards, he was able to see the effects of the various calculations and lab experiments when we ran full-scale tests at our test site in Zeglingen.'

Mr Tadeusz Piotrowski

One of the main things the Ciba experts wanted to show Piotrowski was how S&E measures are implemented. Key topics included the use of decision trees and the standard methods and procedures employed at Ciba for risk analysis. For Piotrowski, the electrostatic measurement of dust and solids was one of the highlights of his visit. In addition, he received training in identifying and classifying risks related to static electricity in powders and other materials. The programme also included visits to companies that manufacture process equipment and machinery.

Piotrowski said he was returning to Poland with a clutch of new ideas that he intends to apply. In particular, he said, he had learned a great deal about new measurement techniques for dust explosions. He was also impressed by computer methods for analysing experimental data and sees several possibilities for putting his new knowledge to practical use. This is exactly what Eigenmann and Glor were hoping for. 'Actually, the training programme was developed with specialists from developing countries in mind,' Eigenmann noted, 'but it is also proved to be useful for colleagues from Eastern Europe. For many years, safety and environmental protection did not exactly have top priority there.' He believes that if training programmes like this can help them close the gap, the effort and expense involved is worthwhile for both sides of the partnership, especially in terms of safety in the chemical industry and environmental quality. For Glor, there is also another issue. Research-based companies in the West use state-of-the-art equipment, and this was certainly something new for Piotrowski. 'Let us hope he will try to persuade the people at home to buy the same equipment, in the interests of the environment.'

Indeed, IUPAC vice president Professor Albert Fischli believes the trainees will benefit on a number of counts. 'They will have seen a company with a chemical production plant situated in the heart of a city. They will have got to know the attitude of employees and the atmosphere of the firm. They will have seen the high priority that is attached to safety and environmental protection in industrialized countries. They will also have had an opportunity to get to grips with specific technical problems that interest them and to establish contact with key experts. All of which will be of great value in their work back home.' Moreover, the participants' performance is assessed at the end of their visit: candidates who do particularly well get a chance to visit a second company, if their performance on the second course is judged to have been very good, they receive a certificate. Although the programme only started this year, Fischli is confident that it will pick up the kind of momentum that will make it into a significant initiative. He envisages between 10 and 12 trainees a year benefiting from training courses of this kind.

Dr Eigenmann, corporate safety officer (left) and Dr Glor both from Ciba-Geigy AG, Basel, Switzerland in one of the company's safety research laboratories.

Pesticide Chemistry

Agrochemical companies took the opportunity to unveil new pesticide leads based on new product chemistry at the 8th IUPAC Congress of Pesticide Chemistry, held in Washington DC, on 4–9 July 1994, a meeting attended by more than 2100 delegates. Bob Fairclough, of the Edinburgh, UK-based agrochemical consultants Wood Mackenzie, picks out some of the most promising new products appearing at the meeting.

Fungicide leads

Several new fungicide leads, often based on new product chemistry, were presented at the conference. Many of these leads have been developed as analogues of existing products, designed using quantitative structure activity relationship (QSAR) techniques.

DuPont, which had a high profile at the meeting, produced an informative poster outlining the synthesis and biological activities of new benzodioxan (1) and benzoxepin amide (2) analogues. These two products are 'tied back' analogues of fenpropimorph. This technique has also been employed by Zeneca to produce other analogues of fenpropimorph. Both analogues showed excellent control of powdery mildew (*Erysiphe graminis*) *in vitro*. However, because of its short persistence, its field performance was not as good as standard fenpropimorph. The developmental product, dimethomorph, originally a Shell discovery and now part of the American Cyanamid portfolio, was the focus of a poster review entitled 'From pharmascreening compounds to an agricultural fungicide'. Dimethomorph exists as both E and Z isomers, although only the latter is effective against oomycete fungi such as *Phytophthora infestans*. Application of the pure Z isomer, however, is no more effective than the E and Z isomer mixture, as a rapid equilibration between the two isomers takes place in sunlight.

American Cyanamid's other fungicidal product is a member of a new family of chemicals within the cyclic imide group; the maleimido anilides (3). Structural modifications of the maleimido anilides have shown that the maleimine double bond is essential for fungicidal activity. *In vitro* and *in vivo* trials with maleimide anilides have shown excellent (100%) control of grape powdery mildew (*Uncinula necator*) at concentrations of 25 p.p.m. Excellent control of other oomycete fungi including *Phytophthora infestans* and *Pythium* spp. is also afforded by the maleimido anilides, although control of *Pythium* has only been shown *in vitro*. The mode of action of SC0858 (4), another anilide fungicide, was the subject of discussion in a poster prepared by researchers at Zeneca. The results from these studies suggest that the fungicidal properties of these compounds is the result of an interaction with the metabolism of methionine in the fungal cell.

Dow Elanco recently discovered a series of novel 4-phenoxyquinolines possessing useful fungicidal activity against rice blast (*Pyricularia oryzae*) and the grey mould (*Botrytis cinerea*). Both of these fungal pathogens are the causal agents of important rice and vine diseases, respectively. Structure activity relationships have shown that the analogue LY214352 (5) gave the highest activity of the series. The company has carried out extensive studies to elucidate the mode of action of LY214352. The results show that the enzyme dihydroorotate DHO-DH is the target site. This is the

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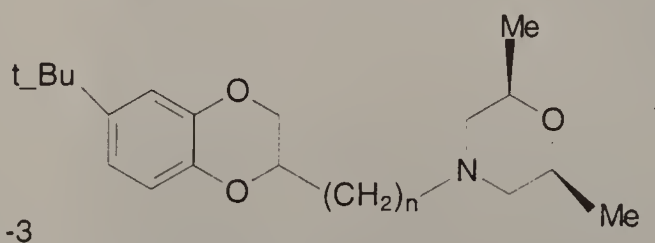

n = 1-3

Benzodioxan amine analog

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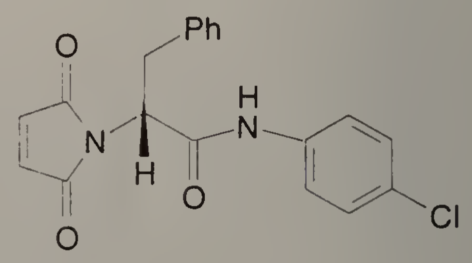

Maleimido anilide

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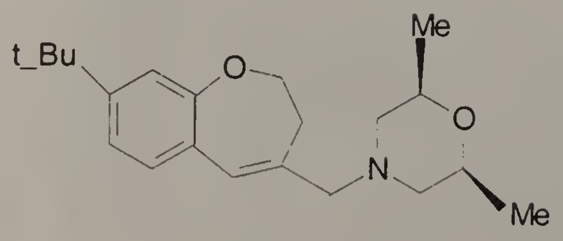

Benzoxepin amine analog

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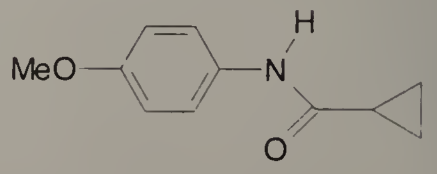

SC0858

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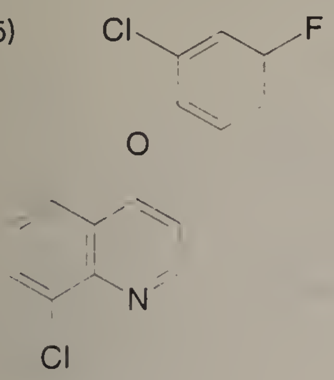

LY214352

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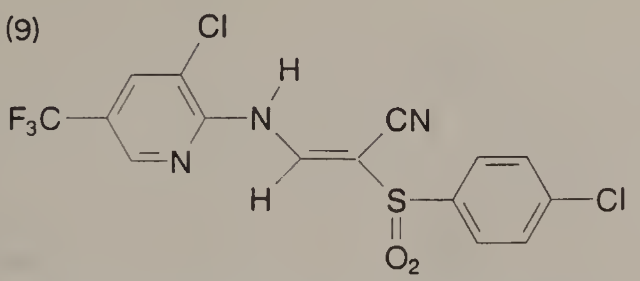

Pyridyl amino propenenitrile derivative

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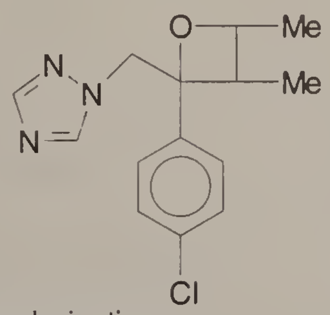

Azole derivatives

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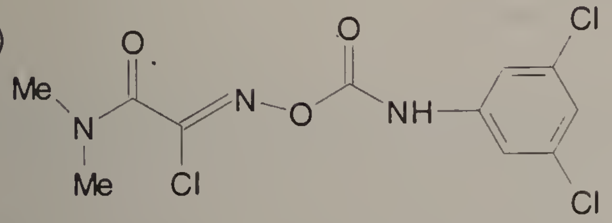

Chlorooxime fungicide

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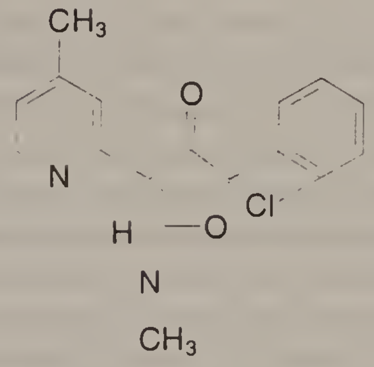

Pyridino-furanones

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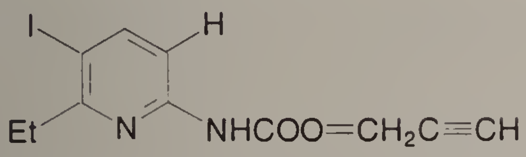

PIEP analog

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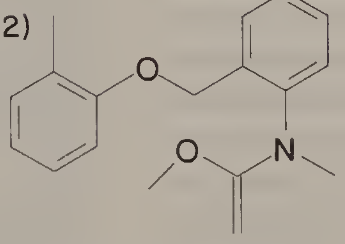

BAS490F analog

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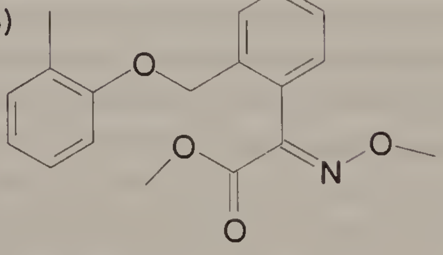

BAS490F

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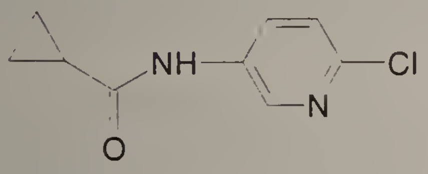

Pyridyl fungicide

first report of this enzyme as an antifungal target, and, as such, LY214352 represents a fungicide with a new mode of action.

The chemistry, biology and mode of action of the oxime fungicides (6) was discussed in some detail in two further posters by DuPont. These fungicides protect against apple scab (*Venturia inaequalis*), peanut leaf spot (*Cercospora arachidicola*), and rice blast (*Pyricularia oryzae*), downy mildew and botrytis *in vitro*. These results are, however, not reproducible in the field, owing to problems of hydrolysis. Consequently, Du Pont has decided to discontinue, at least for the time being, its development of oxime fungicides.

The discovery of a series of pyridyl carbamates showing high potency against both benzimidazole sensitive and resistant isolates of cucumber grey mould (*Botrytis cinerea*) was reported by the Japanese agrochemical firm, Ishihara. The structure activity relationship of these compounds indicates that the analogue PIEP (7) has the best fungicidal activity against both diseases. Indeed, resistance studies carried out by Ishihara have also confirmed previous research which suggests that the cause of fungal resistance to the MBCs is a result of a single point mutation within the fungus cell. Zeneca reported information regarding its discovery of a new class of pyridyl fungicides (8). Activity *in vivo* has been shown against botrytis at concentrations of 20–25 p.p.m. A series of novel pyridyl amino propenenitrile derivatives (9) which, at concentrations as low as 6.25 p.p.m., gave almost 100% control of downy mildew in squash and grapes has been identified by researchers at DowElanco. Activity of these compounds has also been demonstrated on other oomycete fungi.

A unique oxetane (4-membered ring structure) skeleton (10) has been developed by Sankyo. *In vitro* and *in vivo* trials have demonstrated remarkable activity against sheath blight (*Rhizoctonia solani*) in rice and powdery mildew (*Sphaerotheca fuliginea*) in cucumber.

Details of the structural activity relationships of furanone fungicides were presented in a poster by researchers at the Korea Institute of Chemical Technology. These compounds show interesting fungicidal activity *in vitro*. Early work has shown that the pyridine furanones (11) can give up to 100% control against *Pyricularia oryzae* and *Botrytis cinerea* at concentrations of 50 p.p.m.

Natural products are the focus of a great deal of commercial interest. The mode of action of the development fungicide

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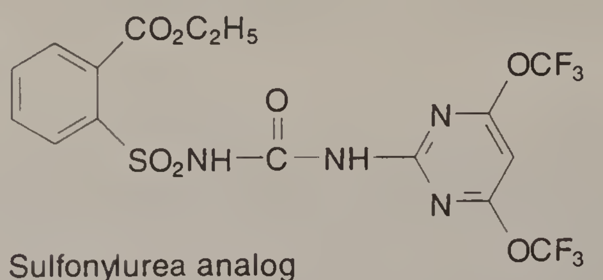

Sulfonylurea analog

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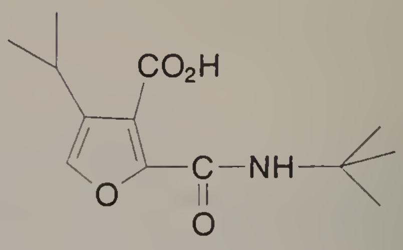

Isoxazole amide

BAS490F (12) – a strobilurine – which is active on apple scab (*Venturia inaequalis*), powdery mildew (*Erysiphe graminis*), and brown rust (*Puccinia recondita*), was the subject of a poster from BASF. The conclusions of this research show that BAS490F acts largely by inhibiting the germination of spores of these plant pathogenic fungi. Inhibition of mycelial growth and sporulation, post infection, has also been demonstrated with isolates of the fungus *E. graminis*. QSAR has shown that structural variations in the oximether pharmacophore of BAS490F (13) results in several structural types, all of which possess high fungicidal activity.

Ciba has also been looking at what nature has to offer. Soraphen A is a potent agricultural fungicide which has been isolated from a species of myxobacteria *Sorangium cellulosum*. Since the original isolation, over 30 other types of the fungicide have been isolated. In an effort to optimize the biological properties of Soraphen A, Ciba has been involved in the preparation of semi-synthetic derivatives of these natural products. A poster from Ciba researchers described how a number of Soraphen V derivatives were synthesized by dimethylation of position 12 of Soraphen A. All of the 12 substituted derivatives, however, proved, in general, less fungicidal than the lead. Interesting activity on *Pyricularia* was, however, noted for one of the derivatives and this may prove to be a potential lead for further development.

Herbicide leads

Herbicides accounted for most of the new product leads which were unveiled at the Congress. As with the fungicides, many of the leads are QSAR analogues of existing products. The one exception being Ciba's new triazole herbicide which has been developed specifically as a plant biosynthesis enzyme inhibitor.

Several of the new product leads presented at the Congress are further developments of the sulfonylurea herbicides. BASF has developed a series of sulfonylurea analogues (14) by substitution of the aromatic moiety using fluoroalkoxy substituted pyrimidines as reactive intermediates. Pre- and post-emergence activity against broadleaved and grass weeds, as well as selectivity for wheat, has been demonstrated at rates of 60–78 g of active ingredient per hectare.

In addition to the development of sulfonylurea analogues, BASF is developing a series of isoxazole-3,4- and isoxazole-4,5- dicarboxylic acid derivatives (15), which show good broadleaved weed herbicidal activity. Glasshouse and field studies of selected compounds have shown post emergence selectivity in maize at rates of approximately 200 g of active ingredient per hectare. The spectrum of weeds which are controlled include *Galium aparine* (cleavers), *Abutilon* spp. (velvet leaf), *Amaranthus* spp. (pigweed), *Chenopodium al-*

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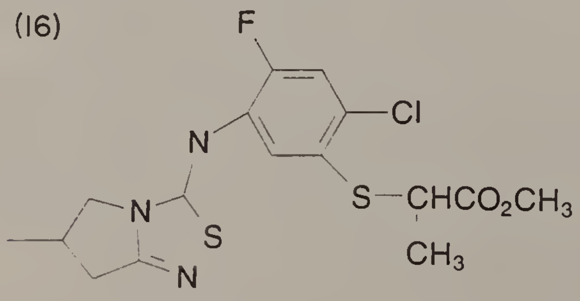

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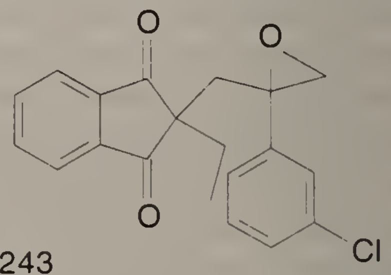

MK243

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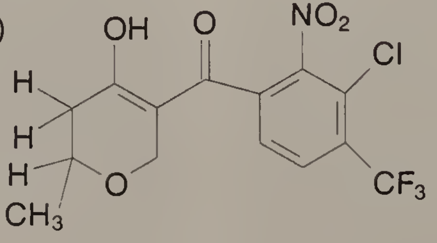

Benzoylpyrone herbicide

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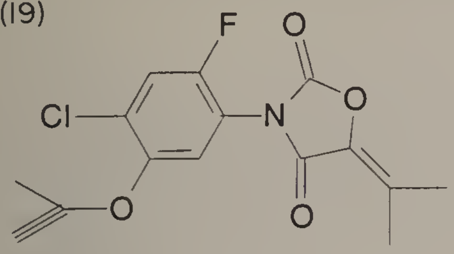

KP300

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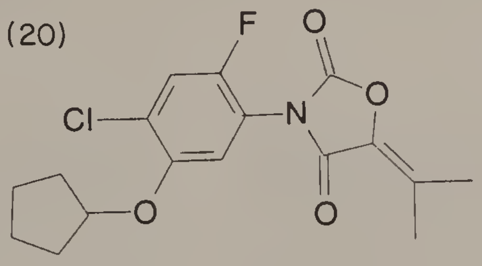

KP314

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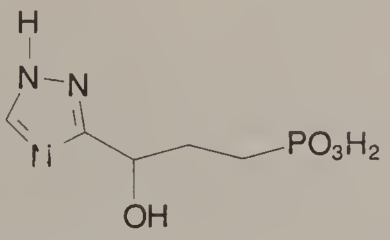


Triazole 1

bum (fat hen), *Datura stramonium* (horn apple), *Ipomoea* spp. (morning glory) and *Solanum nigrum* (black nightshade).

A series of 3-phenylimino-1,2,3-thiadiazole-fused heterocytes which show pre and postemergence herbicidal activity at low rates have been discovered by Nippon Soda. The potency of the herbicidal activity was found to depend upon both the substituents of the benzene ring and heterocyclic moiety. The compound 242479 (16), which shows selectivity to soybean, has been selected for further development. A novel herbicide, MK-243 (17), is being developed, principally for paddy rice, by Mitsubishi Kasei. Trials have shown that MK-243 gives pre and postemergence control of *Echinochloa* spp. (barnyard grass), *Monchoria vaginalis* (pickerel weed), *Cyperus difformis* (umbrella plant) and *Scirpus juncoides* at rates of 150 g of active ingredient per hectare. pre-emergence control of *Alopecurus* spp. (foxtails), *Stellaria media* (chickweed) and *Capsella bursa-pastoris* (shepherds purse) is also afforded in cereals at rates of 200–400 g of active ingredient per hectare.

Details of the benzoylpyrones (18), a new class of bleaching herbicides which are related to sulcotrione, were given by Zeneca. Studies on the structural activity relationships indicate that the Zeneca analogue is likely to give the best herbicidal results. Use rates range between 62 g of active ingredient per hectare (pre-emergence) to 125 g of active ingredient per hectare (post-emergence). Zeneca also reported on derivatives from pseudomonic acids, which have useful postemergence broadleaved and grass weed herbicidal activity. Activity of the derivatives was, however, much less when it was applied pre-emergence. Weeds controlled at around 1000 g of active ingredient per hectare include *Polygonum aviculare* (knotgrass), *Matricaria inodora* (scentless mayweed), *Abutilon theophrasti* (velvet leaf) and *Chenopodium album* (fathen).

A poster which described the synthesis and herbicidal properties of a series of oxazolidinedione derivatives was given by Kaken Pharmaceutical and the Sagami Chemical Research Centre. From these compounds, two analogues, KPP300(19) and KPP314 (20), have been selected for further evaluation. In outdoor pot tests, both showed excellent pre-emergence activity, against *Echinochloa* spp. and *Monochoria vaginalis* at rates of 2–6 g of active ingredient per hectare, whilst being selective in rice, cereals, maize, and soya.

The synthesis and structure activity relationships of bicyclic ether compounds which show potent pre-emergence grass weed activity were presented in a poster by DuPont. Many grass weed species were susceptible at concentrations as low as 16 g of active ingredient per hectare to the more potent analogues.

By following a more biochemical approach to developing herbicides, rather than QSAR, Ciba has developed a total control herbicide. Triazole 1 (21) is a substrate analogue which strongly inhibits imidazole glycerol phosphate dehydratase, an essential enzyme which is involved in the biosynthesis of histidine in plants. Application rate, depending upon plant species and climate, will be between 5 and 4000 g of active ingredient per hectare.

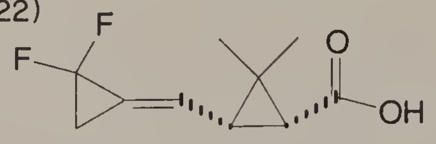
Insecticide leads

Progress in new insecticide leads continues to be made with structural modification of existing products, and with modifications of the pyrethroids in particular. In addition, natural product chemistry is also continuing to yield many new and interesting products, some of which have commercial potential for the future.

In addition to developing herbicide leads from the potent pyrazole class of compounds, DowElanco has synthesized a new group of insecticides – the 4-thio-1-aryl-pyrazoles. Extensive glasshouse and field trials have shown that the pyrazoles have an especially high insecticidal activity against dipteran and coleopteran species. However, Lepidoptera and *Aphis* species are somewhat less efficiently controlled. Fipronil E is a further aryl-pyrazole which is currently being developed by Rhône-Poulenc.

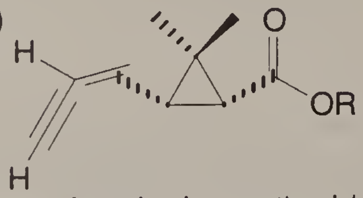
Several new developments have been made with insecticidal pyrethroids. Roussel Uclaf, which is involved in an ongoing synthetic programme towards new pyrethroid acid moieties, presented data relating to the synthesis of substituted difluorocyclopropylmethylene ester (22). The trials have shown that pyrethroids prepared with such an acid part are biologically very active with LD_{100} to *Spodoptera*, *Aphis* and *Diabrotica* spp. at between 0.6 and 10 p.p.m. The com-

(22)



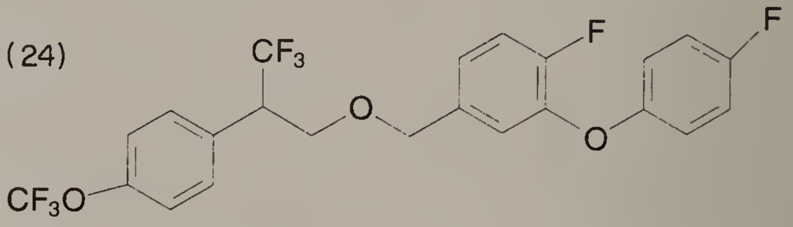
Difluorocyclopropylmethylene

(23)



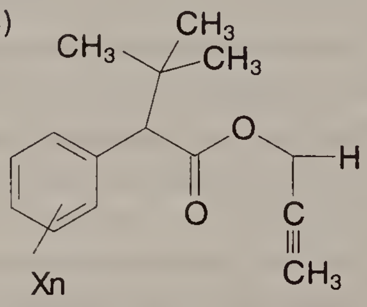
Acetylenic pyrethroids

(24)



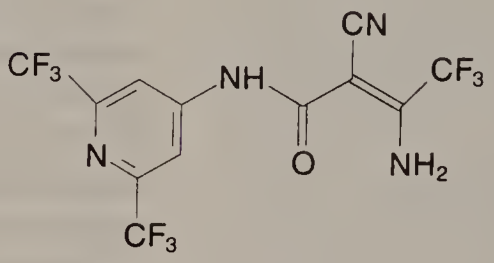
Ether pryrethroid

(25)



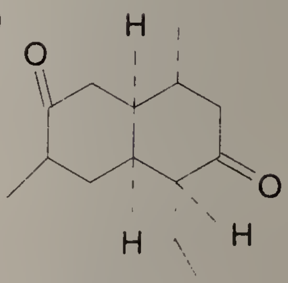
Alkynylester insecticide

(26)



L14165

(27)



Cadinene 9d

pany has also developed highly active acetylenic pyrethroids (23) which show good insecticidal and miticidal activity against *Aphis* sp., *Spodoptera littoralis* and *Tetranychus urticae* at concentrations of 2.5–100 p.p.m.

Zeneca's research with ether-based pyrethroids (24) has yielded a compound which is active against strains of Lepidoptera which are resistant to conventional pyrethroids. Although analogues of the compound resolved initial problems relating to persistency and mammalian toxicity, further development has been suspended as, according to Zeneca, the economics of commercial progression could not be justified.

A new class of soil insecticides, the alkynylesters (25) was reported at the conference by AgrEvo. This new type of ester-pyrethroid, which is particularly effective on *Diabrotica* spp., has, in general, efficiency which is comparable to established soil insecticides. SDS Biotech (Japan) has developed a series of trifluorocrotonamide analogies. Structure activity relationships showed that L14165 (26) is amongst the most potent of all analogues. LC_{50} rates of 9.3 and 33 p.p.m. were obtained for mustard beetle and cotton leafworm, respectively.

The use of natural products as insecticides has been an area of research interest for some time now. Many products, some of which have commercial potential, were reviewed at the Congress. Among the natural products derived from a plant source, Cadinene 9d (27) has been extracted from the plant species *Eupatorium adenphorum* which is found in the mountain regions of Nepal. Various other compounds have also been extracted, but the structures of most of these have not, however, been elucidated, as yet. Cadinene 9d, which shows antifeedant and nematicidal activities, completely controlled root nematodes (*M. incognita*) at 500 p.p.m. The antifeedant activity of the neo-clerodane diterpenoids isolated from the Mexican plant species Salvia was also reviewed. Significant activity against larvae of *Spodoptera littoralis* was obtained at 10–100 p.p.m.

Among the natural products derived from fungal sources, the nematicidal activities of aromatic nitro compounds produced by *Streptomyces* spp. were reviewed. Several of these compounds show 100% mortality to different nematode spp. at between 0.1 and 1 µg/mL. Further novel potential insecticides, in the form of fungal sclerotia, were discussed at the Congress. Fungal sclerotia have, in trials, shown activity against *Helicoverpa zea* the compares favourably with the commercial synthetic insecticides malathion and permethrin. Studies have revealed more than 75 natural products, 45 of which possess previously unreported structures, from the sclerotia of *Aspergillus* spp. alone. An insecticidal compound, codenamed BK226, has been isolated from a culture broth of the ascomycete fungus *Pyrenophora teres.* Although antifungal compounds have previously been isolated from fungal broths this is the first isolation of a compound with insecticidal activity. Inhibition of the growth of several insect species including *Spodoptera exigua, Helicoverpa virescens* and *Drosophila melanogaster* has been demonstrated as a result of BK226 application.

PAC Review

Pure and Applied Chemistry (*PAC*) is IUPAC's official journal. It publishes the main invited lectures of symposia sponsored by the Union; the recommendations of its Commissions on nomenclature, symbols and units, and technical reports on standardization, recommended procedures, collaborative studies and data compilations. Summaries of the most recent IUPAC recommendations on nomenclature and symbols, and technical reports appearing in *PAC* are published in *Chem. Intl.* in the section Recent Reports. In this section we take a brief look at the symposia and lectures published in recent issues of *PAC*.

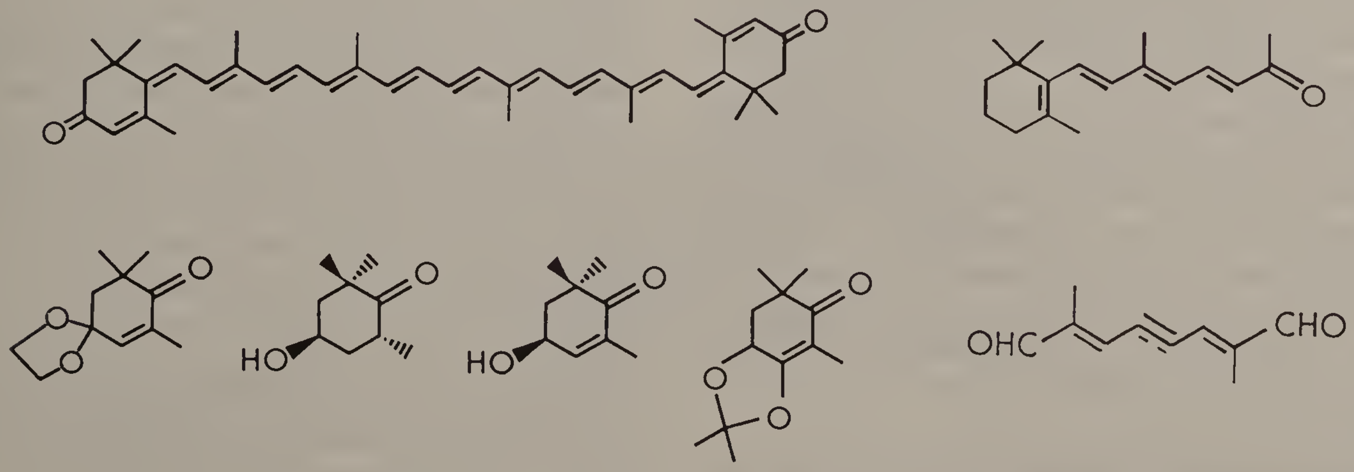
Carotenoids

As a satellite meeting before the IUPAC natural Products Symposium in Stockholm, Sweden in 1966, a Symposium on Carotenoids other than Vitamin A was arranged in Trondheim, Norway. This was the first on a now well established series of international symposia on carotenoids, which have been held at three yearly intervals. According to George Britton, the symposium editor, it was appropriate that the 10th symposium, held on 20–25 June 1993, should return to Trondheim. In the preface to proceedings of the 10th International Symposium on Carotenoids, published in the July issue of *Pure Appl. Chem.* and dedicated to the memory of Dr Otto Isler, Britton notes that attendance and participation at the two Trondheim meetings indicates the growth in interest in carotenoids. The 1966 meeting attracted 31 participants, the 1993 symposium was attended by 233 participants from 29 countries. In addition to the 19 invited plenary and session lectures published in the July issue of *Pure Appl. Chem.* 46 selected oral presentations were made, and 135 posters accepted for display.

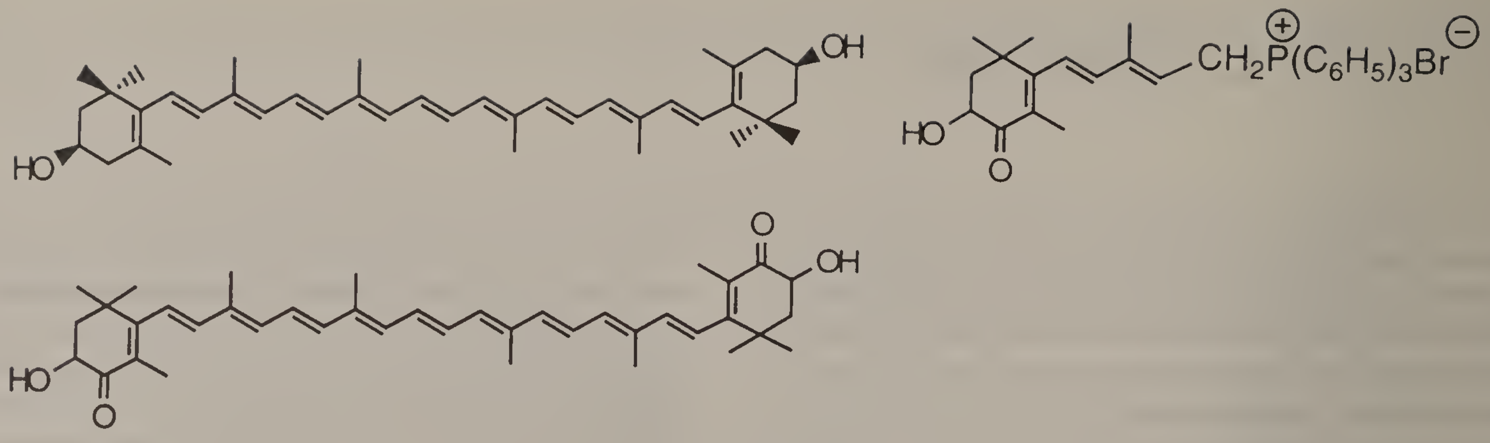
One of the presenters at the first symposium also made a contribution at the 10th. H. Mayer of Hoffmann-La Roche treated the audience to his 'Reflections on carotenoid synthesis'. He reminded the audience that it was at the first symposium as 'a greenhorn in the field' he had the privilege to present the first total synthesis of rhodoxanthin. After profiling some of the highlights in carotenoid synthesis in the past 30 years, Mayer focused on some of the critical issues now facing the discipline, as well as identifying trends and opportunities. First of all, existing processes must be improved, he told delegates, particularly the recycling and regeneration of chemical auxiliaries and solvents. Second, new reactions and technologies have to be invented or developed. Mayer believes that embedded immobilized enzymes and micro-organisms will become the methodology of choice thus reducing the formation of useless biomass. The impact of molecular biology cannot be over-emphasised, Mayer added.

It is not surprising that the retinoids, the name given to a class of compounds structurally related to Vitamin A, have attracted a lot of attention. They have already established themselves in the successful treatment of various dermatological diseases such as acne, psoriasis and other keratinizing dermatoses. It is their potential as cancer therapeutics that is, however, attracting all the attention. In a paper titled, 'Retinoids in oncology: Experimental and clinical aspects', Roche's Werner Bollag described the experimental and clinical aspects of retinoids in oncology. Indeed, the clinical use of retinoids in oncology is still in its infancy, although results from preclinical studies and clinical trials have resulted in cautious optimism that retinoids may prove to be useful in prevention and therapy of various types of cancer. Nevertheless, Bollag noted, the discovery of new retinoids with a more favourable therapeutic index is mandatory for these treatments to become acceptable for long- term preventative therapies.

Rodney Ausich, of Amoco Technology Company, revealed that some of the challenges highlighted by Mayer are close to being met. He reminded delegates that although carotenoids are produced by a diverse group of organisms, ranging from bacteria to higher plants, this biological and synthetic capability has not been exploited to develop systems for the production of carotenoids; it is very low compared with production by chemical synthesis. Currently, only beta-carotene and astaxanthin are produced from biological sources and sold.



Rhodoxanthin and some important building units.



Zeaxanthin, astaxanthin and an important C_{15}-building unit.

widely to the food and feed industries. One way to increase the production of carotenoids in biological systems is to use recombinant DNA techniques. Indeed, carotenoid biosynthesis should be amenable to such biotech techniques because all carotenoids share a common precursor. In his paper, 'Production of carotenoids by recombinant DNA technology, ' Ausich described how he and his colleagues identified and characterized the carotenoid genes from *Erwinia herbicola* and then used them to effect carotenoid synthesis in different host cells.

Other papers presented at the symposium and published in *Pure Appl. Chem.* are:

- 'Recent progress in carotenoid and retinoid synthesis' by M. Ito, Y. Yamano, S. Sumiya and A. Wada (Kobe Women's College of Pharmacy, Japan).
- 'HPLC and SFC of carotenoids: Scope and limitations' by H. Pflander, R. Riesen and U. Niggli (University of Berne, Switzerland).
- 'Conventional and specially designed carotenoids: synthesis, optical properties and conductivity' by S. Beutner, O. Gräf, K. Schaper and H.-D. Martin (University of Düsseldorf, Germany).
- 'Synthesis of isotopically labelled carotenoids; investigations on structure and function of carotenoproteins at the atomic level' by F. J. H. M. Jansen and J. Lugtenburg (Leiden University, The Netherlands).
- 'Carotenoproteins: advances in structure determination' by P. F. Zagalsky (University of London, UK).
- 'Phodopsins containing 6- to 9-membered rings. The triggering process of visual transduction' by K. Nakanishi, A.-H. Chen, F. Derguini, P. Franklin, S. Hu and J. Wang (Columbia University, USA).
- 'Isomerization reactions of retinoids in the visual system' by R. R. Rando (Harvard Medical School, USA).
- 'The biological properties of carotenoids' by N. I. Krinsky (University School of Medicine Boston, USA).
- 'Adsorption, transport, and metabolism of carotenoids in humans' by J. A. Olsen (Iowa State University, USA).
- 'Recent advances in clinical research involving carotenoids' by A. Bendich (Hoffmann-La Roche Inc. USA).
- 'The chemoprevention of cancer by dietary carotenoids: studies in mouse and human cells' by J. S. Bertram (University of Hawaii, USA).
- 'Carotenoids: nature's unique pigments for light and energy processing' by T. A. Moore, D. Gust and A. L. Moore (Arizona State University, USA).
- 'Carotenoids as accessory light-harvesting pigments' by R. J. Cogdell, T. Gillbro, P. O. Andersson, R. S. H. Liu and A. E. Asato (University of Glasgow, UK).
- 'Biochemical aspects of carotene desaturation and cyclization in chromoplast membranes from *Narcissus pseudonarcissus*' by P. Beyer, V. Nievelstein, S. Albabili, M. Bonk and H. Kleinig (Universität Freiburg, Germany).
- 'Regulation of carotenoid biosynthesis genes during plant development' by P. A. Scolnik and G. Giuliano (DuPont Central Research, USA).
- 'Developments in world aquaculture, feed formulations, and role of carotenoids' by S. P. Meyers (Louisiana State University, USA).

In his preface, Britton notes that the 24-hour days of midsummer week in Trondheim provided ample opportunity for stimulating informal discussion and the promotion of international collaboration, the benefits of which will surely be seen at the next Symposium. The 11th Symposium in the series will be held in Leiden, The Netherlands, in summer 1996.

Plasma Chemistry

Five plenary and 20 topical lectures from the 11th International Symposium on Plasma Chemistry, held in Loughborough, UK, on 22–27 August 1993, have been published in the June issue of *Pure Appl. Chem.*

R. d'Agostino (Università di Bari, Italy) provided an insight into the chemistry of etching and deposition processes. He reminded delegates that the great deal of work performed in the last decade, in the field of plasma processing, produced at least two important results. First, it prompted impressive growth of utilization of plasma technology for many applications. Secondly, it has provided a generalized minimum understanding of the microscopic mechanism of interaction, particularly for the etching processes. The former point is witnessed by the relevance of novel applications for biomaterials, food packaging, tool hardening, microelectronics, optics and optoelectronics, etc. The latter issue has generated a noticeable decrease of fundamental work addressed to the understanding of plasma-surface interaction mechanism.

D'Agostino and his colleagues revealed that X-ray photoelectron spectroscopy system (XPS) surface analysis, particularly with an *in situ* approach, coupled with plasma diagnostic techniques, gives a fairly good insight of plasma-surface interactions. Specific examples d'Agostino used included etching of Al, Ti, TiN, W, and deposition of thin films from organosilicon precursors.

C. Benndorf and colleagues (University of Hamburg, Germany) described mass spectroscopy (MS) and optical emission spectroscopy (OES) of plasmas for diamond synthesis. It is well established that different techniques can be applied for the low-pressure synthesis of diamond. Recently a ternary C/H/O phase diagram for low pressure diamond synthesis has been published which suggests that the plasma chemistry for a defined C/H/O ratio leads to identical radicals and gas phase species, independently from the different source gases. Benndorf and colleagues described how they used MS and OES techniques to test the phase diagram. They revealed that it is possible to deposit diamond in a microwave reactor without extra hydrogen addition. However, they add, to achieve diamond deposition it is necessary to reduce the $\cdot CH_3/H$ concentration ratio in the plasma by the addition of oxygen.

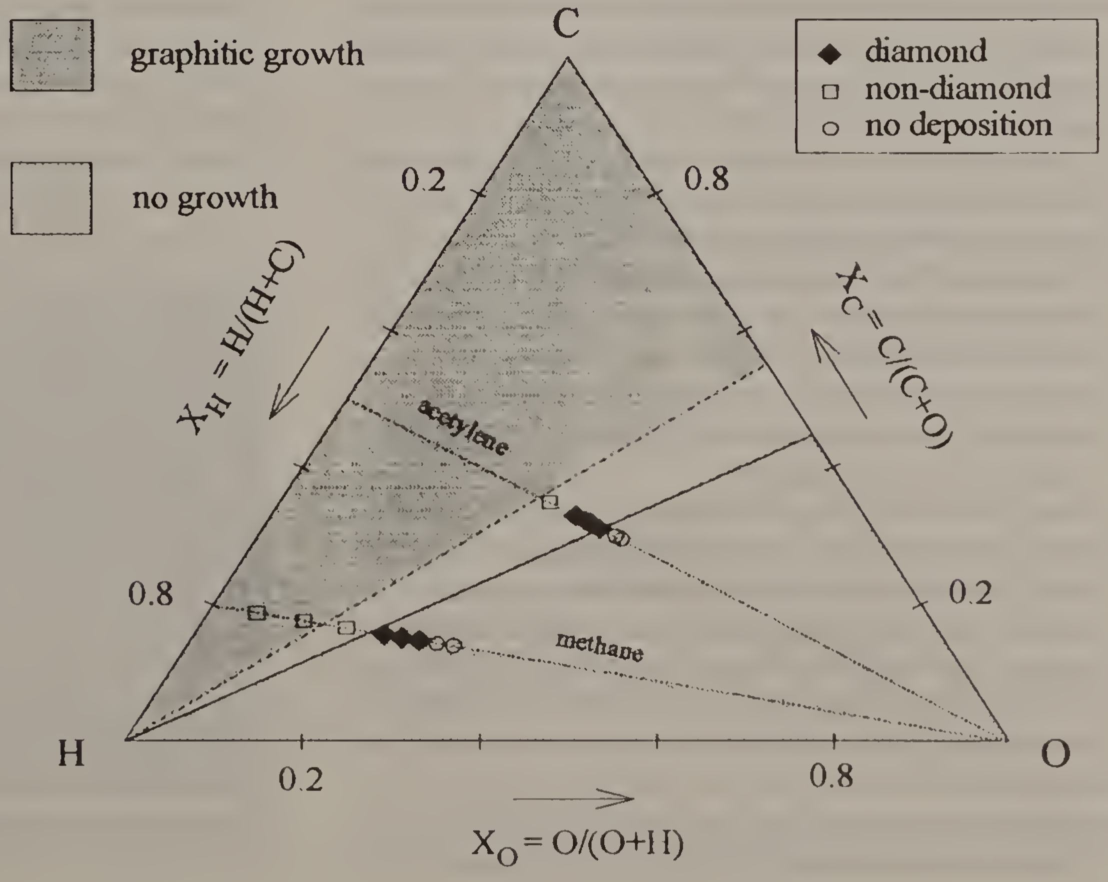
G. Hancock and colleagues (Oxford University, UK) discussed the determination of concentrations, energy distributions, and kinetics of selected atoms, radicals and ions by means of optical observations in radiofrequency parallel plate plasma reactors. Hancock focused his review on measurements conducted at Oxford, mainly using LIF, of each of these types of species. The technique, when used carefully, can satisfy the noninvasive requirement of a plasma diagnostic. But, the Oxford scientist noted, it is not the universal solution for all plasma observations. By necessity the species to be observed by the technique must fluoresce. Many, and in particular polyaromatic radicals and molecules, do not. For species which do, Hancock reports, the technique delivers the information required, spatially resolved absolute concentrations and energy distributions. Moreover, it can provide data on surface processes inside the plasma chamber.

Countries of the former Soviet Union are suffering from a severe crisis, O. Yas'ko (Belorussian Academy of Sciences, Belarus) told delegates. Living standards of top scientists have fallen below those of manual workers, financial problems are constraining the work, even telephone and mail communications are being curtailed because of the drain on budget resources. There is a brain drain either to other countries or to other professions, Yas'ko observed. Despite this gloomy backdrop, Yas'ko was able to inform the conference that a great number of organizations are concerned with plasma research and application in the former Soviet Union. Yas'ko detailed some of the highlights of plasma research talking place in former Soviet Republics including activities associated with plasma generation, plasma chemistry, metallurgy energetics, plasma spraying, electrode-region phenomena, modelling, and diagnostics.

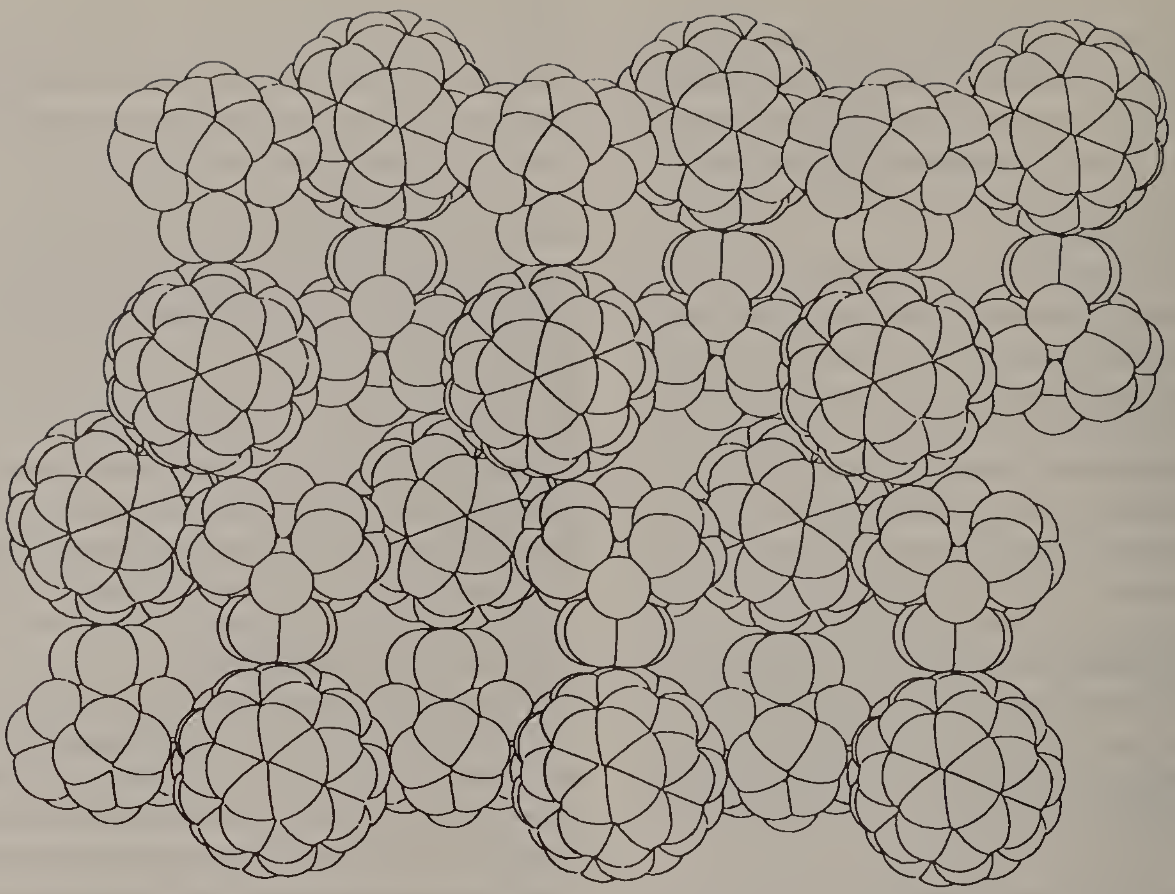
The future of thermal plasma processing for coating looks bright, according to T. Yoshida (University of Tokyo, Japan). Reviewing the role of injection plasma processing (IPP) in the coating field, Yoshida proposes 'high rate and large area thermal plasma CVD' and 'thermal plasma flash evaporation of multicomponent system' as two distinctive candidates for the future development of IPP for coating, especially high performance ceramics technology, though the scientific understanding of the processes is at an early stage. Without doubt, Yoshida adds, another promising IPP relating to ceramics technology exists in the field of plasma spraying. The novel spray coating techniques such as radiofrequency plasma spraying and hybrid plasma spraying will open new spraying fields in the near future.

Other papers presented at the symposium and published in *Pure Appl. Chem.* have been separated into two categories – thermal plasmas and low-pressure plasmas. Topical lectures published in the thermal plasma section are:

- 'Plasma fluidized and spouted bed reactors: an overview'



Phase diagram with borders proposed by Bachmann. Shown are the results of deposition experiments with $Ar/CH_4/O_2$ and $Ar/C_2H_2/O_2$ gas mixtures.



Space-filling representations of the $C_{60}\cdot Cp_4Fe_4(CO)_4$ host lattice structure; view perpendicular to *bc* plane (C_6H_6 molecules omitted for clarity). The double-columnar stacks of C_{60} molecules are perpendicular to the plane of the paper (along *a* axis).

by G. Flamant (CNRS, France).

- 'High temperature processing and numerical modelling of thermal plasmas in Norway' by J. A. Bakken (The Norwegian Institute of Technology, Norway).
- 'Plasma spraying: present and future' by P. Fauchais and M. Vardelle (University of Limoges, France).
- 'Diagnostic techniques for plasma reactor temperature and species determination in advanced materials processing' by W. C. Roman and J. C. Hermanson (United Technologies Research Centre, USA).
- 'Theoretical basis of nonequilibrium near atmospheric pressure plasma chemistry' by A. A Fridman and V. D. Rusanov (RRC Kurchatov Institute, Russia).
- 'Modelling of dielectric barrier discharge chemistry' by B. Eliasson, W. Egli and U. Kogelschatz (ABB Corporate Research, Switzerland).
- 'Theory of electric corona including the role of plasma chemistry' by J. J. Lowke and R. Morrow (CSIRO Division of Applied Physics, Australia)
- 'High power plasma arc melting process for incinerated ash contraction' by K. Kinoshita, A. Hayashi, K. Akahide and T. Yamazaki (Kawasaki Steel Corporation, Japan).
- 'Gliding arc. Applications to engineering and environment control' by A. Czernichowski (Université d'Orléans, France).

Topical lectures published in the low pressure plasmas section are:

- 'The reactive spluttering of oxides and nitrides' by R. P. Howson (Loughborough University of Technology, UK).
- 'Nucleation, growth, and morphology of dust in plasmas' by A. Garscadden (Wright-Patterson Air Force Base, USA).
- 'Electron cyclotron resonance plasma etching of Si with Cl_2: plasma chemistry and mechanisms' by K. Ono, M. Tuda, H. Ootera and T. Oomori (Mitsubishi Electric Corporation, Japan).
- 'Plasma processing techniques used at Caswell' by D.A. Tossell, M. C. Costello, A. P. Webb and K. C. Vanner (GEC-Marconi Materials Technology, UK).
- 'Processing of electronic materials by microwave plasma' by M. R. Wertheimer and M. Moisan (École Polytechnique, Canada).
- 'Decomposition of gaseous dielectrics (CF_4, SF_6) by a nonequilibrium plasma. Mechanisms, kinetics, mass spectrometric studies and interactions with polymeric targets' by Y. Khairallah, F. Khonsari-Arefi and J. Amouroux (Université Paris, France).
- 'Self consistent low pressure RF discharge modelling: comparisons with experiments in clean and dusty plasmas' by Ph. Belenguer and J. P. Boeuf (Université Paul Sabatier, France).
- 'Plasma and surface diagnostics in PECVD from silicon containing organic monomers' by P. Favia, R. d'Agostino and F. Fracassi (Università bi Bari, Italy).
- 'Real-time monitoring of surface chemistry during plasma processing' by E. S. Aydil, R. A. Gottscho and Y. J. Chabal (University of California Santa Barbara, USA).
- 'The fullerenes – precursors for 21st century materials' by A. G. Avent, P. R. Birkett, C. Christides, A. D. Darwish, P.

B. Hitchcock, H. W. Kroto, M. F. Meidine, K. Prassides, R. Taylor and D. R. M. Walton (University of Sussex, UK).

- 'Plasmaphysical and plasmachemical aspects of diamond deposition in low pressure plasmas' by A. Ohl (Institute for Low Temperature Plasma Physics, Germany).

Organometallic Chemistry

Proceedings of the 7th IUPAC Symposium on Organometallic Chemistry directed towards Organic Synthesis (OMCOS-VII), held in Kobe, Japan, on 19–23 September 1993, have been published in the July issue of *Pure Appl. Chem.* According to Symposium Chairman Professor S.-I. Murahashi (Osaka University, Japan), OMCOS-VII followed the previous successful OMCOS meetings at Fort Collins (1981), Dijon (1983), Kyoto (1985), Vancouver (1987), Florence (1989) and Utrecht (1991). OMCOS-VII attracted more than 980 participants from 26 countries. The aim of the symposium, Murahashi writes, was to present recent results, promote discussion of trends, and the exchange of ideas relating to the use of organometallics in organic synthesis.

The scientific programme of the symposium included seven plenary lectures, 15 invited lectures, and 45 short lectures. Moreover, 337 posters were displayed during the symposium. among all the presentations, Pd was most widely used, and the second was Ru, followed by Si, Cu, Sn, Co, Rh, Ni, Fe, B, Sm, Li, Ti, Cr, Pt, Te, Mo, Mg, Zn, Zr, Mn and Os. One of the characteristics of this symposium is the demonstration of industrial usefulness of organometallics for the synthesis of fine chemicals and drugs in many aspects. The July issue of *Pure Appl. Chem.* sees publication of six of the plenaries and 14 of the invited lectures.

In his plenary paper 'Tricarbonyliron lactone complexes in organic synthesis', S. V. Levy (University of Cambridge, UK) described the use of π-allyltricarbonyliron lactone and lactam complexes for the synthesis of lactones. He also emphasized their application to the preparation of various biologically active molecules, such as beta-lactones and some pyrrolizidine alkaloids. Levy also proposed using iron carbonyl groups as templates for asymmetric reactions. The inherent chirality associated with the irontricarbonyl unit is ideally placed to allow highly stereoselective addition reactions to substituents located in proximity to it. Such reactions would open up new possibilities for asymmetric synthesis.

IUPAC Symposium on
Organo-Metallic Chemistry
directed towards Organic Synthesis

Professor S.I. Murahashi delivers the opening speech at OMCOS VII.

The utility of intramolecular Heck reactions for establishing demanding quaternary carbon centres in the synthesis of complex organic molecules was confirmed by L. E. Overman (University of California Irvine, USA). In his plenary lecture 'Application of intramolecular heck reactions for forming congested quaternary carbon centres in complex molecule total synthesis', Overman described how palladium-catalysed cyclizations of aryl halides, vinyl halides and vinyl triflates with tethered alkenes have proven to be powerful reactions for forming congested quaternary carbon centres. Indeed, in some cases, use of enantiopure ligands allows the new quaternary centre to be formed with excellent enantioselectivity. Overman demonstrated the scope, stereochemical nuances, and power of the chemistry using, as examples, the total syntheses of (±)-pretazettine (±)-tazettine (–)- and (+)-morphine (–)- and (+)-physostigmine (±)-scopadulcic acid A, and (±)-scopadulcic acid B. Overman is convinced that this powerful approach for constructing congested carbon skeleta is certain to be more widely used in the future.

H. Sakurai (Tohuku University, Japan) focused his plenary lecture, 'An approach to stable organic molecules of the triplet state via organosilicon route', on stable triplet states for benzene dianions and dications. Sakurai told delegates that these are not only theoretically important but that they are interesting as potential components of organic molecular ferromagnetic materials. Dianions of hexakis(trimethylsilyl) benzene and 1, 2, 4, 5-tetrakis(trimethylsilyl)benzene were described. The former has a boat-deformed structure of nonaromaticity with two lithium atoms at the same side of the benzene ring, the latter has a planar structure of antiaromaticity with two lithium atoms on both sides of the benzene ring. The dianion of a specially designed hexasilylbenzene with three fused rings shows triplet ESR signals in the 100–370 K temperature range, Sakurai noted.

The appropriate choice of a metalating reagent, according to M. Schlosser (Université de Lausanne, Switzerland), is the key to optional deprotonation of benzylamine derivatives at a position adjacent to the substituent of the nitrogen bearing side chain or even at the benzylic alpha position of the latter. In his plenary lecture 'Site selective hydrogen/metal exchange: competition and co-operation between superbases and neighbouring groups', Schlosser revealed that immediately when generated some organometallic intermediates can undergo a rapid second hydrogen/metal exchange process but that dimetalation is only kinetically, not thermodynamically favoured. Dimetalation can be avoided, Schlosser added, if the donor capacity of the solvent or the polarity of the metalating reagent is increased. Allylic organopotassium compounds exhibit intriguing stereopreferences which Schlosser has exploited in a number of very simple sesquiterpene syntheses.

R. R. Schrock (Massachusetts Institute of Technology, USA) revealed in his plenary lecture 'Recent advances in the chemistry and applications of high oxidation state alkylidene complexes' that it is now relatively simple to prepare precursors to a wide variety of catalysts containing Mo or W from metal oxides or oxyhalides on a relatively large scale in three or four high yield steps. He also revealed that catalyst activity can be finely controlled, that many functionalities are tolerated. Moreover, he noted catalysts are at present available that should allow new applications in organic chemistry to be

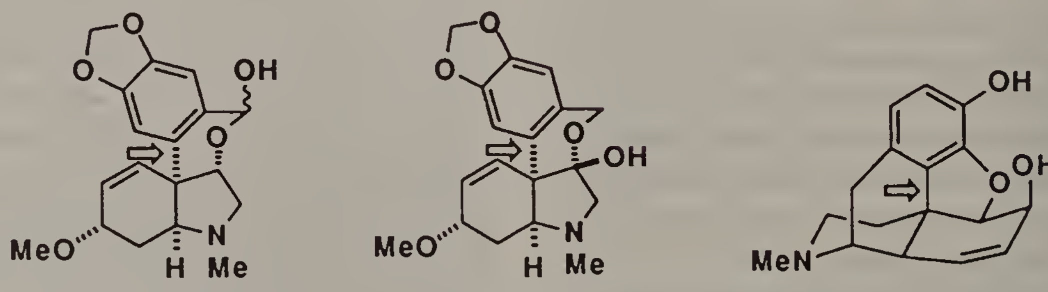
Professor S. Ley lecturing on tricarbonyl iron chemistry.

explored and the stoichiometric reactions may be economically feasible for certain highly prized molecules.

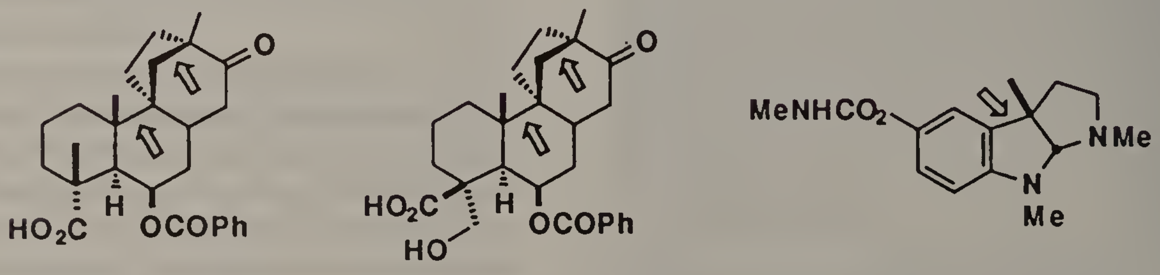
In his plenary lecture, 'Asymmetric catalysis with chiral organocopper-copper arenethiolates', G. van Koten (Utrecht University, The Netherlands) explained how novel copper arenethiolates, $[CuSAr]_n$, which have as a special feature the presence of a potentially co-ordinating *ortho* amino group, $CH(R')NMe_2$, have been developed as catalysts for the conjugate 1, 4-addition of Grignard to Michael acceptors. Indeed, he demonstrated that the ortho amine substituted arenethiolate copper compounds CuSAr are versatile catalysts in the 1, 4-conjugate addition of Grignard reagents to enones. When chiral CuSAr is used, e.e.'s of up to 80% have been achieved, he adds.

Other papers presented at the symposium and published in the July issue of *Pure Appl. Chem.* are:

- 'Controlling stereochemistry in C–C and C–H bond formation with electronically asymmetric organometallics and chiral poisons' by J. W. Faller, M. R. Mazzieri, J. T. Nguyen, J. Parr and M. Tokunaga (Yale University, USA).
- 'Palladium-catalysed cross-coupling reaction of organometalloids through activation with fluoride ion' by T. Hiyama and Y. Hatanaka (Tokyo institute of Technology, Japan).
- 'Enantioselective synthesis via sparteine-induced asymmetric deprotonation' by D. Hoppe, F. Hintze, P. Tebben, M. Paetow, H. Ahrens, J. Schwerdtfeger, P. Sommerfeld, J. Haller, W. Guarnieri, S. Kolczewski, T. Hense and I. Hoppe (University of Münster, Germany).
- 'Asymmetric synthesis mediated by chiral ligands' by K. Koga (University of Tokyo, Japan).
- 'New synthetic methods based on organozirconium and organocopper chemistry' by B. H. Lipshutz, A. Bhandari, C. Lindsley, R. Keil and M. R. Wood (University of California Santa Barbara, USA).
- 'Construction of alpha alkylidene-gamma-butyrolactones from acyclic ester precursors' by X. Lu, S. Ma, J. Ji, G. Zhu and H. Jiang (Shanghai Institute of Organic Chemistry, PRC).
- 'Organometallic chemistry in industrial vitamin A and vitamin E synthesis' by C. Mercier and P. Chabardes (Rhône-Poulenc Recherches, France).
- 'Biomimetic oxygenations catalysed by metalloporphyrins and metallophorphinoids bearing cocatalytic functions' by F. Montanari (Università e Centro CNR, Italy).
- 'Catalytic C–H/olefin coupling' by S. Murai, F. Kakiuchi, S. Sekine, Y. Tanaka, A. Kamatani, M. Sonoda and N. Chatani (Osaka University, Japan).
- 'Electronic effects in asymmetric catalysis: enantioselective carbon–carbon bond forming processes' by T. V. RajanBabu and A. L. Casalnuovo (DuPont Central Research and Development, USA).
- 'Transition metals as assembling and templating species: from catenanes and knots to strings threaded through molecular rings' by J.-C. Chambron, C. O. Dietrich-



(±)-6a-epipretazettine (±)-tazettine (-)- and (+)-morphine



(±)-scopadulcic acid B (±)-scopadulcic acid A (-)-and (+)-physostigmine

Recently synthesized natural products containing official quaternary carbon centres. Bonds to the quaternary centres prepared by intramolecular Heck reactions are shown with an arrow.

Professor D. S. Matteson (Washington State University, USA) receiving the poster prize.

Buchecker, J.-F. Nierengarten and J.-P. Sauvage (Université Louis Pasteur, France).

- 'A practical asymmetric synthesis of LTD_4' by I. Shinkai, A. O. King and R. D. Larsen (Merck Research Laboratories, USA).
- 'Novel Lewis acid catalysis in organic synthesis' by K. Suzuki (Keio University, Japan).
- 'Sulfoxides and stereochemical control in organometallic chemistry' by S. L. Griffiths, C. F. Marcos, S. Perrio, S. P. Saberi, S. E. Thomas, G. J. Tustin and A. T. Wierzchleyski (Imperial College London, UK).

The next symposium, OMCOS-VIII, is scheduled for 6–10 August 1995, and will be held in Santa Barbara, California.

Beijing Congress

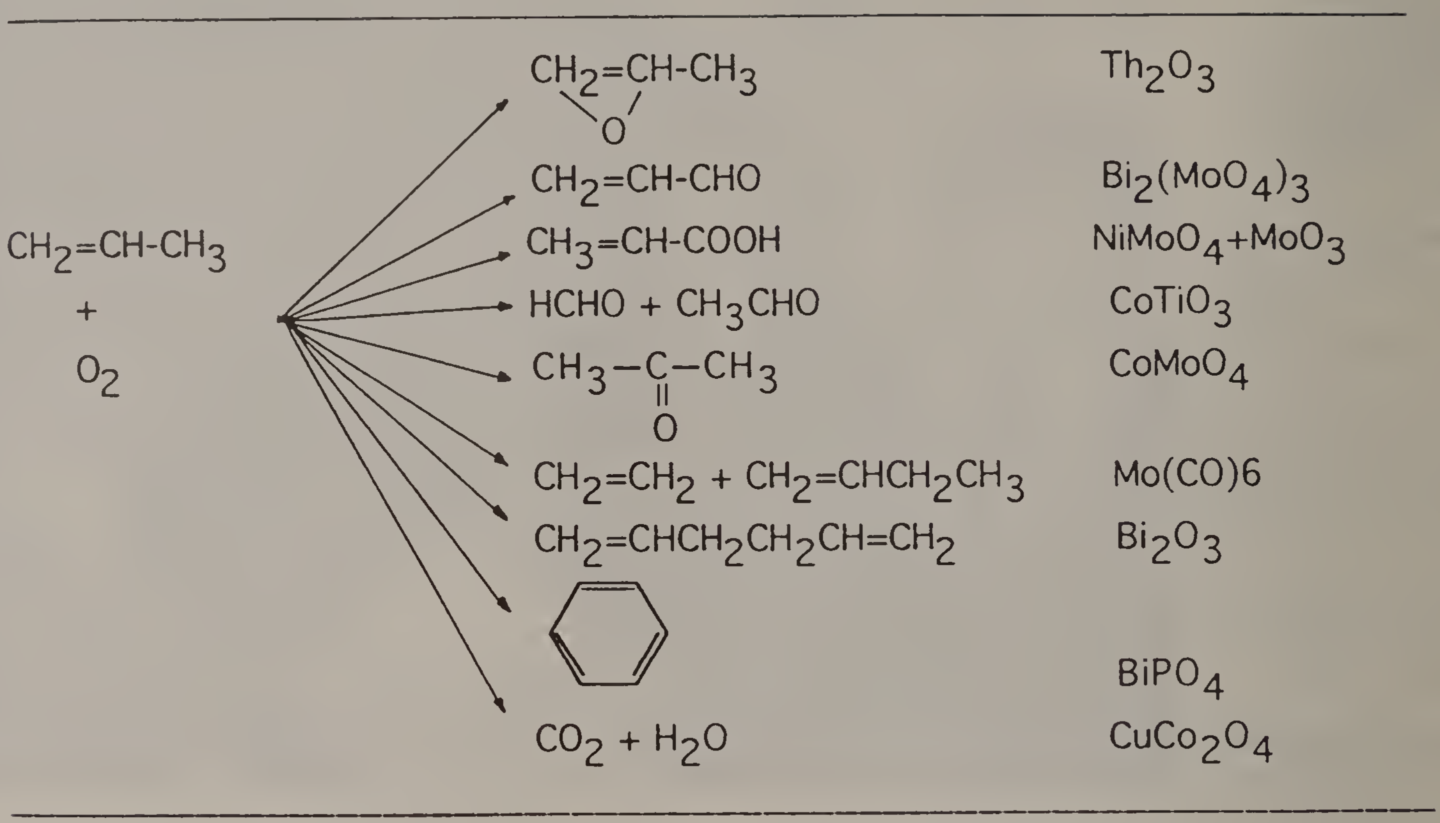
Five of the eight plenary lectures presented at the 34th IUPAC Congress, held in Beijing, PRC, on 15–20 August 1993, have been published in the August issue of *Pure Appl. Chem.* The Congress, held in conjunction with the Chinese Chemical Society, attracted almost 1000 scientists from 49 countries who were treated to a total 919 papers.

Enzymes differ from simple catalysts in many respects. They bind substrates in well-defined geometries. They generally use simultaneous bifunctional or even polyfunctional catalyses. The results of these stylistic advantages are improved rates and high selectivities, properties that are clearly attractive to the organic chemist. R. Breslow (Columbia University, USA), in his plenary lecture 'Biomimetic chemistry' focused on the recent efforts of his laboratory to apply enzymatic principles in simpler chemical systems. Breslow described how dimers made up of linked cyclodextrins show very strong selective substrate binding, and with catalytic groups in the linkers they are effective catalysts of reactions of bound substrates. He illustrated his lecture with other examples such as chelate binding of transition states by a base and an acid which produce effective catalysts whose geometric preferences reflect the detailed mechanisms of the catalysed processes. Breslow also showed that chelate binding to biological receptors of some molecules with two polar end groups produces a class of particularly effective cytodifferentiating agents, which are of potential use in cancer chemotherapy.

Usage of NMR for exploring molecular structure and molecular dynamics was reviewed by R. R. Ernst (Eidgenössische Technische Hochshule, Switzerland) in his plenary paper 'Recent developments in NMR methodology for the study of molecular structure and dynamics'. He told delegates at the Congress that NMR has revealed an enormous and seemingly unlimited potential for the investigation of structural and dynamic properties of molecules and materials. He illustrated this potential by referring to its use in determining the three dimensional structures of biomolecules, as well as highlighting more recent advances with dynamics modelling. Ernst reckons that further exciting applications well be discovered in the future and there is hardly a field of science where new applications of NMR are not worth exploring.

Computer techniques are now playing an important role in the drug discovery process. Indeed, as W. G. Richards (Oxford University, UK) noted in his presentation 'Computer-aided drug design', all the world's leading major pharmaceutical and biotechnology companies are now using computational design tools. According to Richards, two distinct approaches are possible in the area of computer-aided design. A detailed molecular structure of the target macromolecule, the drug receptor, is known from X-ray crystallography, NMR or homology modelling. The target receptor binding site has properties which can only be inferred from a knowledge of the variable activity of otherwise similar molecules. Computers are now being used to develop compounds that have DNA as their target, or protein as their target, and that

Products of propene oxidation on different catalysts.



have enhanced transport properties to ensure that they are in the right place at the right time. Computers are also being used to predict three dimensional protein structures. Indeed, Richards and his co-workers have been able, using software developed by Oxford Molecular, to predict the structure of the interleukin-4 receptor. On this basis, Richards says it should be possible to design mimetics which would interfere with the biochemical consequences of the cytokine binding to the receptor, leading to antagonists with potential medicinal applications.

J. Haber (Polish Academy of Sciences, Poland) described the role of catalysts, and their mechanisms, in the chemical industry in his paper 'Catalysis – where science and industry meet'. Catalysis represents a global market in 1994 of some USD7.3 billion, with more than 90% of all chemicals production deriving from catalysed reactions. Catalysis is a fast moving science, Haber contends. He backs this assertion by focusing on the influence of electronic structure transition metal atoms, structure sensitivity of catalytic reactions, tailoring of acid-base and redox properties of zeolites, quantum chemical description of elementary reaction steps, dynamics of catalyst surfaces, oscillatory reactions, supramolecular and micellar catalysis, and catalytic antibodies, as examples of the state of the art with respect to catalysis. Future challenges for catalyst designers include sustainable increases of production at lower energy consumption and limited waste generation, removal of environmental pollution, and development of new energy sources. He also envisages the molecular design of integrated catalytic systems using nanotechnology and tailored to the needs of any given reaction.

The process by which some organic molecules may aggregate, coaggregate, deaggregate and self coil may provide insight into the causes and possible treatment of arteriosclerosis, a disease linked to the hardening of the arteries. According to X. K. Jiang, in his paper, 'New concepts for studying and understanding the aggregation, coaggregation, deaggregation and self-coiling of organic molecules. Why are cholesterols and triglycerides culprits of arteriosclerosis?', their coaggregating tendencies may be the key. Jiang is working towards developing methodologies to measure the relative coaggregating tendencies of these culprit molecules, as well as other important biological substances, such as phospholipids and esters of multi-unsaturated acids. Jiang believes that nontoxic deaggregators could be developed as useful substances for preventing or even curing arteriosclerosis. His team has already succeeded in combining a hydrophilic moiety, for example a sugar residue, with various alkyl chains, and has had success in the initial search for effective neutral deaggregators.

The 1990s and the first part of the 21st century will be a period of high growth rates with technology driving economic development. According to D.-S. Yan (Chinese Academy of Sciences, PRC), materials science and engineering, and new materials will be on the few cornerstones for such development, with advanced inorganic materials showing faster rates of development than other materials. In his paper 'Material chemistry studies – their role for the development of advanced nitride materials', Yan addressed the role of material chemistry for the synthesis and processing of advanced materials. He chose to illustrate the two issues that demonstrate that material studies are important by using advanced nitride materials that, may be generated within the complex Si–Al–Y–N–O system. These, he noted, are: first, the phase compositional design of materials guided by a detailed knowledge of the phase relationships of these complex systems; and second, the kinetics relating to the processing of silicon nitride solid solution-sialon complexes, and its influence on microstructure development. Success will, however, depend on close collaboration between chemists and material scientists.

The 35th IUPAC Congress will be held in Istanbul, Turkey, on 14–19 August 1995, in conjunction with the Turkish Chemical Society.

Details of the congress appear on pp. 201–203.

Recent Reports

In this section we publish summaries of the most recent IUPAC recommendations on nomenclature and symbols and technical reports. The full texts of these recommendations and reports are published in *PAC.*

Reporting of stable hydrogen, carbon, and oxygen isotopic abundances (Technical Report)

To eliminate possible confusion in the reporting of isotopic abundances on non-corresponding scales, the Commission on Atomic Weights and Isotopic Abundances recommended at the General Assembly at Lisbon, Portugal that (I) $^{2}H/^{1}H$ relative ratios of all substances be expressed relative to VSMOW (Vienna Standard Mean Ocean Water) on a scale such that $^{2}H/^{1}H$ of SLAP (Standard Light Antarctic Precipitation) is 0.572 times that of VOMOW, (ii) $^{13}C/^{12}C$ relative ratios of all substances be expressed relative to VPDB (Vienna Peedee belemnite) on a scale such that $^{13}C/^{12}C$ of NBS 19 carbonate is 1.00195 times that of VPDB, and (iii) $^{18}O/^{16}O$ ratios of all substances be expressed relative to either VSMOW or VPDB on scales such that $^{18}O/^{16}O$ of SLAP is 0.9445 times that of VSMOW.

This report was prepared for publication by T. B. Coplen, Commission on Atomic Weights and Isotopic Abundances, Inorganic Chemistry Division, and published in Pure Appl. Chem. ***66**, 273–276 (1994).*

Analyte isolation by solid phase extraction (SPE) on silica-bonded phases: Classification and recommended practices (Technical Report)

This article reviews the technique of solid phase extraction (SPE) using silica bonded phases. In the first section, a classification is given of the different analyte isolation techniques and SPE is defined. An overview is given of the different kinds of sorbents available, especially focusing on the chemically bonded silica phases. Further sections deal with SPE in practice: a description of a typical extraction column, the outlines of off-line SPE, the importance of flow rate, the capacity of the sorbent and what the important factors are for method development.

Attention is paid to the different binding mechanisms in SPE as selectivity is a function of the interaction among the matrix, the analyte and the sorbent. Selectivity can be further enhanced using a combination of more than one solid phase, ion-pair SPE or solvent changeover. Furthermore the possibilities of trace enrichment and the fractionation of complex mixtures are considered. two critical points in SPE, namely the between-batch and between-manufacturer variation and the possible elution of interfering compounds from the cartridge housing are discussed. In the section on automation, a description is given of the available equipment for off-line and on-line SPE. Finally, the applications of SPE are outlined.

This report was prepared for publication by M. Moors, D. L. Massart and R. D. McDowall, Commission on Commission on General Aspects of Analytical Chemistry, Analytical Chemistry Division, and published in Pure Appl. Chem. ***66**, 277–304 (1994).*

Applications of accelerator mass spectrometry in analysis of trace isotopes and elements (Technical Report)

Accelerator mass spectrometry (AMS) is mainly employed to measure very low concentrations of a number of long-lived radioisotopes and stable isotopes with very high sensitivities. The predominant application of AMS is in the field of geosciences and is based on chronological evaluations and dating principles. This paper deals with AMS applications other than dating problems, aiming at the analytical aspects of the trace isotopes and trace elements. It addresses non-dating applications in the fields of nuclear physics, geology, hydrology, environmental sciences which have received increasing attention. Comparison of AMS with other analytical techniques with respect to detection limits and other functions is also discussed.

This report was prepared for publication by Liu Yuanfang, Guo Zhiyu, Liu Xinqui, Qu Tong and Xie Jinglin, Commission on Radiochemistry and Nuclear Techniques, Analytical Chemistry Division, and published in Pure Appl. Chem. ***66**, 305–334 (1994).*

Pesticides report 31: Effects of storage and processing on pesticide residues in plant products (Technical Report)

Residues of pesticides in food are influenced by the storage, and handling and processing that occurs between harvesting of raw agricultural commodities and consumption of prepared foodstuffs. Reviewing the extensive literature showed that in most cases these steps lead to large reductions in residue levels in the prepared food, particularly through trimming, washing and cooking operations.

Residues of post harvest insecticide treatment on stored staples such as cereal grains and oil seeds generally decline only rather slowly. However, processing into foods again results in large losses except for unrefined oils. the behaviour of residues in storage and processing can be rationalised in terms of the physico-chemical properties of the pesticide and the nature of the process. EBDC fungicides are examined in more detail as a class of fungicides of concern due to the formation of the toxic breakdown product ETU.

Recommendations are provided for the conduct of storage or processing studies on fate of pesticide residues in food so that data obtained is relevant, comparable and may be extrapolated to other situations.

This report was prepared for publication by P. T. Holland, D. Hamilton, B. Ohlin and M. W. Skidmore, Commission on Agrochemicals, Applied Chemistry Division and published in Pure Appl. Chem. ***66****, 335–356 (1994).*

Measurement of total nickel in body fluids: electrothermal atomic absorption methods and sources of preanalytic variation
(Technical Report)

Before attempting to establish reference concentrations of Ni in the blood serum or plasma, a laboratory must be working comfortably at the 2 nmol/L level. To achieve this, scrupulous acid-leaching of all materials that come into contact with the sample is essential, and blood collection with non-metallic systems is advisable. A particle-free environment (clean-air laboratory) seems necessary.

Values of Ni in serum above 1.7 to 5.1 nmol/L are suspect; values in the urine of people without occupational or other unusual environmental exposures are an order of magnitude higher. For reported concentrations to be meaningful, the reference population must be thoroughly described in terms of age, sex, place of residence, occupation, diet, alcohol and tobacco use, medications and medical history, as all such factors may influence the actual concentrations of Ni.

Sampling procedures must be standardized (for instance for time of day, season, posture of the person, etc.) and reported. Storage, if necessary, should minimize opportunities for sample adulteration, and these must be evaluated empirically. Preparation of samples should also minimize processing; acidification or protein precipitation with ultrapure nitric acid are adequate for clear body fluids. Analysis by ET-AAS with Zeeman correction is the most useful approach currently available.

This report was prepared for publication by Douglas M. Templeton, Commission on Toxicology, Clinical Chemistry Division and published in Pure Appl. Chem. ***66****, 357–372 (1994).*

Glossary of terms used in physical organic chemistry
(IUPAC Recommendations 1994)

This glossary contains definitions and explanatory notes for terms used in the context of research and publications in physical organic chemistry. Its aim is to provide guidance on physical organic chemical terminology with a view to achieve a far reaching consensus on the definitions of useful terms and on the abandonment of unsatisfactory ones. As a consequence of the development of physical organic chemistry, and of the increasing use of physical organic terminology in other fields of chemistry, the 1994 revision of the Glossary is much expanded in comparison to the previous edition, and it also includes terms from cognate fields. A few definitions have been refined, some others totally revised in the light of comments received from the scientific community.

This report was prepared for publication by P. Muller, Commission on Physical Organic Chemistry, Organic Chemistry Division, and published in Pure Appl. Chem. ***66****, 1077–1184 (1994).*

Properties of ethylene-dimethylaminoethylmethacrylate copolymers as poly (vinyl chloride) resin modifier
(Technical Report)

Morphological, physical and mechanical properties of the blends of poly (vinyl chloride) (PVC) with (ethylene-dimethylaminoethylmethacrylate copolymer) (E-DAM) were studied. From the dynamic mechanical characterization of the PVC/E-DAM blends it was concluded that E-DAM was slightly compatible with PVC due to the specific interaction between the alpha-hydrogen of PVC and the tertiary amine group of E-DAM. Measurements of the tensile stress-strain behaviour and of the Izod notched impact strength were carried out for a series of PVC/E-DAM blends in the composition range of 0–15wt% of E-DAM. Improved toughness and impact strength is observed when the amount of E-DAM is 10wt%. Transmission and scanning electron micrographs of PVC/E-DAM blends show E-DAM domain sizes ranging from 0.1–1 μm. E-DAM forms the continuous phase when the composition exceeds 12wt%. In the ternary blend of PVC/E-DAM/PE, E-DAM acts as a compatibilizer for the PCV/PE system. Addition of small amounts of PE into PVC/E-DAM blends enhances the toughness of the mixture.

This report was prepared for publication by Sung Chul Kim, Byung Suk Jin, Tadayuki Ohmae, Toshiro Masuda and Akio Nakajima, Commission on Polymer Characterization and Properties, Working Party on Structure and Properties of Commercial Polymers, Macromolecular Division, and published in Pure Appl. Chem. ***66****, 1405–1414 (1994).*

Recommendations for nomenclature and tables in biochemical thermodynamics
(IUPAC Recommendations 1994)

Chemical equations are written in terms of specific ionic and elemental species and balance elements and charge, whereas biochemical equation are written in terms of reactants that often consist of species in equilibrium with each

Professor Bob Alberty, a member of the Panel on Biochemical Thermodynamics

other and do not balance elements that are assumed fixed, such as hydrogen at constant pH. Both kinds of reaction equations are need in biochemistry. When the pH and the free concentrations of certain metal ions are specified, the apparent equilibrium constant K' for a biochemical reaction is written in terms of sums of species and can be used to calculate a standard transformed Gibbs energy of reaction ${}_{\Delta r}G'^{0}$. Transformed thermodynamic properties can be calculated directly from conventional thermodynamic properties of species. Calorimetry or the dependence of K' on temperature can be used to obtain the standard transformed enthalpy of reaction ${}_{\Delta r}H'^{0}$. Standard transformed Gibbs energies of formation ${}_{\Delta f}G'^{0}(i)$ and standard transformed enthalpies of formation ${}_{\Delta f}H'^{0}(i)$ for reactants (sums of species) can be calculated at various T, pH pMg, and ionic strength (I) if sufficient information about the chemical reactions involved is available. These quantities can also be calculated from measurement of K' for a number of reactions under desired conditions. Tables can be used to calculate ${}_{\Delta r}G'^{0}$ and ${}_{\Delta r}H'^{0}$ for many more reactions.

This report was prepared for publication by Robert A. Alberty, IUBMB-IUPAC joint Commission on Biochemical Nomenclature, Panel on Biochemical Thermodynamics, and published in Pure Appl. Chem. ***66*** *1641–1666 (1994).*

Thin films including layers: terminology in relation to their preparation and characterization (IUPAC Recommendations 1994)

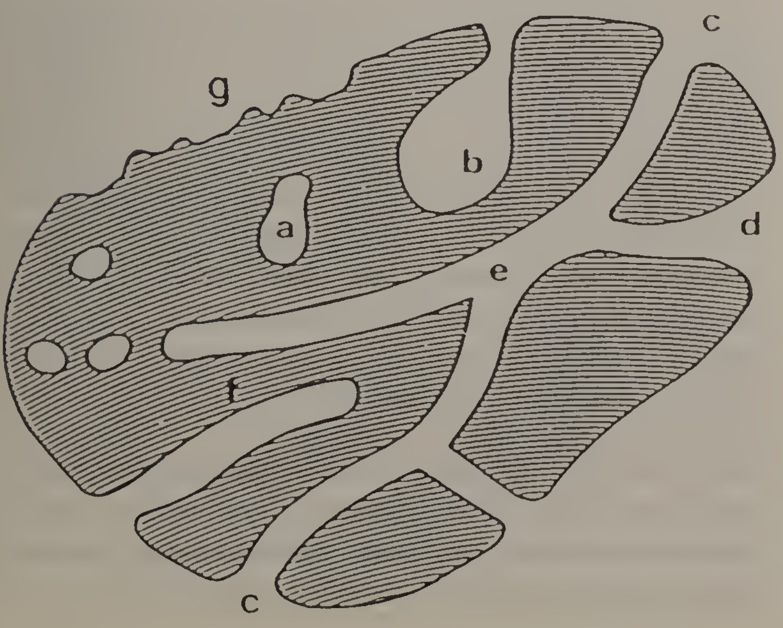
This report deals with the terminology in relation to the preparation and characterization of liquid and solid thin films and layers, it is not comprehensive, in that no consideration is given to certain types of layers such as ferromagnetic, ferroelectric, He or liquid metal films. Topics covered include: general terminology and characterization methods applicable to both solid and liquid films; terminology and characterization methods applicable specifically to either liquid or solid films, layers and multilayers. Comprehensive indexes of terms and methodologies (preparation and characterization) are given.

This report was prepared for publication by L. Ter Minassian-Saraga, Commission on Colloid and Surface Chemistry, Physical Chemistry Division and published in Pure Appl. Chem. ***66****, 1667–1738 (1994).*

Recommendations for the characterization of porous solids (IUPAC Recommendations 1994)

These recommendations aim to be a tool for the selection and appraisal of the methods of characterization of porous solids, and to give the warnings and guidelines on which experts generally agree. For this purpose, they consider the description of a porous solid (definitions, terminology), the principal methods available (stereology, radiation scattering, pycnometry, adsorption, intrusion, suction, maximum bubble pressure, fluid flow, immersion or adsorption calorimetry, thermporometry, size exclusion chromatography, Xenon NMR and ultrasonic methods) and finally the general principles which are worth following in the selection the appropriate method.

This report was prepared for publication by J. Rouquérol, D. Avnir, C. W. Fairbridge, D. H. Everett, J. H. Haynes, N. Pernicone, J. D. F. Ramsay, K. S. W. Sing and K. K. Unger, Commission on Colloid and Surface Chemistry, Sub-Committee on Characterization of Porous Solids, Physical Chemistry Division and published in Pure Appl. Chem. ***66****, 1739–1758 (1994).*



Left: Schematic cross-section of a porous solid. A first Category of pores, closed pores, are isolated form their neighbours (a). Pores which have a continuous channel with the external surface of the body like (b) – (f) are open pores. Those open at one end (b) & (f) are described as blind pores. Pores open at two ends are through pores. Pores may also be classified as to their shape: cylindrical (c) and (f); ink bottle shaped (b); funnel shaped (d). Roughness of surface (g) is not porosity unless the irregularities are deeper than they are wide.

Provisional Recommendations

IUPAC seeks your comments

In this section we publish synopses of IUPAC's latest provisional recommendations on nomenclature and symbols. All comments on these recommendations are welcome and will be taken into consideration. The final revised versions are published in *Pure and Applied Chemistry* and synopses of these are published in *Chem. Intl.* as recent reports.

If you would like to comment on the Provisional Recommendations please write to your nearest national/regional centre requesting a copy of the full report. Copies are not available from the IUPAC Secretariat. The most up-to-date list in the national/regional centres appeared in *Chem Intl* **15**, 209 (1993).

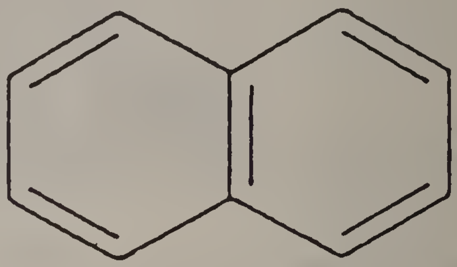
Detection of radiation

This document deals with nomenclature, symbols and their usage in the field of instrumentation for Radiation Detection as used in analytical atomic and molecular emission, absorption, and fluorescence spectroscopy in the X-ray and optical wavelength region (i.e. from 10 pm to 1 mm). The whole subject is divided into 12 chapters dealing with various aspects of detectors including basic aspects of radiation detection as well as all radiation detectors of practical importance, with the exception of photographic emulsions. Definitions are given for detector properties, thermal detectors, photoemissive detectors, semiconductor detectors, and spatially resolving detectors. The properties of detectors are defined in detail with emphasis on such fundamental figures of merit as responsivity, quantum efficiency, noise, detectivity, linearity, and temporal characteristics. The document does not deal with any associated electronics. In some cases detectors for X-rays, which are generally based on the effect of X-rays on the electronic structure of matter, are treated separately.

Comments on these recommendations are welcome and should be sent by 30 April 1995 to: Dr D. S. Moore, Chemical Science and Technology Division, Los Almos National Laboratory, Los Almos, New Mexico 87544, USA.

Nomenclature of fused and bridged fused ring systems

Fusion nomenclature is a technique for naming polycyclic ring systems which do not have a trivial name and where any pair of rings have no more than two atoms and one bond in common. The ring system is considered as a two dimensional array and is analysed to identify the most preferred component ring system, then remaining rings are identified as attached components. The common bond(s) and atoms between the components are indicated in the name.



Two rings that have only two atoms and one bond in common are said to be *ortho*-fused, e.g. naphthalene

The system is considered to be mancude (maximum number of noncumulative double bonds) and any saturated positions are identified by indicated hydrogen. With bridged fused ring systems two nonadjacent positions are linked by a bridge of one or more atoms which may be either saturated or unsaturated. This bridge must not create a ring which is better named as part of the fused ring system.

Fusion nomenclature is described briefly in *A Guide to IUPAC Nomenclature of Organic Compounds* (Recommendations 1993). This document provides the first comprehensive description of this nomenclature systems. The *CAS Ring Systems Handbook* lists over 94000 ring systems of which approximately 75% involve fused ring systems. Copies of the document are available from IUPAC regional centres.

Comments on these recommendations are welcome and should be sent by 30 April 1995 to: Dr G. P. Moss, Department of Chemistry, Queen Mary and Westfield College, Mile End Road, London E1 4NS, UK (e-mail g.p. moss@ qmw.ac.uk).

Laser-based molecular spectroscopy for chemical analysis – Laser fundamentals

This report is the 15th in a series on Spectrochemical Methods of analysis issued by IUPAC Commission V.4. It is concerned with the fundamental properties of lasers as used in analytical molecular spectroscopy in the optical wavelength region. The present report has five main sections: Introduction to lasers; Types of lasers; Laser propagation; Laser dynamics, and Exploitation of laser properties.

Comments on these recommendations are welcome and should be sent by 30 April 1995 to: Dr D. S. Moore, Chemical Science and Technology Division, Los Almos National Laboratory, Los Almos, New Mexico 87544, USA.

Publications

Solubility Data Series Volume 55 – Actinide Nitrates

Oxford University Press (OUP) has published its second volume of the Solubility Data Series. Volume 55 contains critically evaluated data on the solubility of actinide nitrates as a function of temperature in aqueous and organic solvents. Data are presented in two forms: tables of the original experimental values which were obtained from research publications; and recommended values. A discussion describing the rationale for selecting and rejecting data fitted to the solubility equation is included.

The IUPAC Solubility Data Series, ISSN 0191-5622, is published quarterly by OUP. Subscription is USD395 a year. Enquiries should be addressed to OUP, 2001 Evans Road, Cary, NC 27513, USA (USA and Canada enquiries only); or Journals Customer Services Department, OUP, Walton Street, Oxford OX2 6DP, UK.

Solution Calorimetry

Solution Calorimetry, the fourth volume in the IUPAC series 'Experimental Thermodynamics', has been published. Assembled by K. N. Marsh and P. A. G. O'Hare, two leading experts from an international team of contributors, this volume considers the calorimetry of both reacting and nonreacting systems. The contributors present the current state of the development of techniques for the measurement of energy effects involved in reaction and mixing in solution over a range of temperature and pressure.

Solution Calorimetry, ISBN 0865428522, is priced at GBP69.50/USD105.00 (IUPAC member price GBP41.70/ USD63.00) and can be ordered from: Anna Rivers, Science Marketing, Blackwell Science, Osney Mead, Oxford OX2 0EL, UK. US customers should contact: CRC Press Inc., 2000 Corporate Boulevard NW, Boca Raton, FL 33431, USA.

Multilingual Dictionary of Analytical Terms

Conceived as an idea some 17 years ago at the Warsaw General Assembly in 1977, IUPAC has now completed publication of a multilingual dictionary for analytical chemistry. Prepared for publication by Robert A Chalmers, it has been devised to serve two purposes. The first is the translation between seven languages of the terminology of analytical chemistry. Each of over 2600 entries is listed in English, French, German, Spanish, Russian, Chinese and Japanese. The system of cross-referencing used allows translation from any of the languages into the other six.

The second role of the Multilingual Dictionary is as a companion to the first and second editions of the IUPAC Orange Book, the Compendium of Analytical Nomenclature The English listing and cross-reference system of the Dictionary provide a combined multilingual index to the terms given in the two editions of the Orange Book.

Multilingual Dictionary of Analytical Terms, ISBN 086542859-X, is priced at GBP39.50/USD70.00 (IUPAC member price GBP23.70/USD42.00) and can be ordered from: Anna Rivers, Science Marketing, Blackwell Science, Osney Mead, Oxford OX2 0EL, UK. US customers should contact: CRC Press Inc., 2000 Corporate Boulevard NW, Boca Raton, FL 33431, USA.

Japanese edition of the 'Purple Book' published

IUPAC's Compendium of macromolecular nomenclature (the 'Purple Book'), which was prepared by W. V. Metanomski and published by Blackwell Scientific Publications (Oxford) in 1991, has been translated into Japanese by members of the committee of macromolecular nomenclature of Society of Polymer Science, chaired by Koichi Hatada (Osaka, Japan).

The Japanese edition, ISBN 4-89501-572-6, is published by McGraw-Hill Publishing Co. Japan, Ltd, 77 Bldg. 4-14-11 Ginza, Chuo-ku, Tokyo 104, Japan.

Data Sources in Asian-Oceanic Countries

CODATA has published the report of its Taipei meeting of the Task Group on Data Sources in Asian-Oceanic Countries, which was held on 9–10 March 1994. The meeting involved 80 participants from throughout Asia and Oceania. Delegates heard 38 presentations including reports on country endeavours, biological and biotechnological databases, physical databases, geoscience databases, oceanographic/aquatic databases and specialized databases.

Copies of the volume, ISBN 1-884893-02-3 (hardbound) or ISBN 1-884893-03-1 (softbound), are obtainable from: Codata secretariat, 51 Boulevard de Montmorency, 75016 Paris, France; Edgar F. Westrum, Jr, Codata Editor-in-chief, Department of Chemistry, University of Michigan, Ann Arbor, Michigan 48103, USA; Professor Jen-Leih Wu, Academia Sinica, Institute of Zoology, Nankang, Taipei, Taiwan, China.

New Data Challenges in Our Information Age

CODATA, in collaboration with the ICSU Panel on World Data Centres, has published the proceedings of its 13th international conference, held in Beijing, China, on 19–22 October 1992. The volume contains 68 of the invited papers presented at the conference. It presents the current status of, and prospects for further advances in the fast evolving world of scientific and technological data. The proceedings are divided into three sections: Database Developments and Materials and Engineering Data; Earth, Space and the Environmental Sciences; and Databases in Chemistry, Biochemistry and Molecular Biology.

Copies of the volume, ISBN 1-884893-04-X (hardbound) or ISBN 1-884893-05-8 (softbound), are obtainable from: Codata secretariat, 51 Boulevard de Montmorency, 75016 Paris, France.

Receptor Nomenclature and Drug Classification

The International Union of Pharmacology Committee on Receptor Nomenclature and Drug Classification (NC-IUPHAR) has published, in a special issue of *Pharmacological Reviews*, seven official documents relating to receptors. The special issue contains three distinct categories of reports. First, the NC-IUPHAR recognizes that the fields of adrenoreceptors, 5-hydroxytryptamine receptors and protanoid receptors have reached maturity and that enough information is available to propose an official nomenclature to be recommended for usage as such in all journals and books dealing with pharmacology of cell membrane receptors. Secondly, in new areas of science, such as the report on endothelin receptors, the NC-IUPHAR has made every possible effort to interact early with the major contributors in the field, to prevent ill-considered attempts at unsuitable classifications and to implement its general principles of nomenclature. These also represent the official IUPHAR nomenclature, which may be elaborated and extended as more knowledge is accumulated but should not change in terms of general design. The third category concerns classifications that have been accepted by the NC-IUPHAR *only* until more information allows the development of a more logical framework and system of classification. The article in the special issue of *Pharmacological Reviews* on purinoreceptors falls into this category. NC-IUPHAR says that although such documents cannot be considered definitive, they, nevertheless, provide an important forum accessible to the whole pharmacological fraternity for a debate that should lead improvements based on scientific grounds alone.

Pharmacological Reviews, PTS/ISSN 0031-6997, is published by the American Society for Pharmacology and Experimental Therapeutics. Correspondence regarding the journal should be addressed to Customer Service. Subscriptions, Williams & Wilkins, 428 E. Preston Street, Baltimore, MD 21202-3993.

Environmental Aspects of Industrial Wood Preservation – A Technical guide

The United Nations Environment Programme has published a technical guide (Technical Report No. 20) covering the environmental aspects of industrial wood preservation. Forestry operations was among the priority action areas highlighted in Agenda 21, the plan of action signed at the 1992 Earth Summit. There is great concern over the rate at which forest resources are dwindling under the relentless pressure to produce more paper and timber. Chemical preservation which extends the service life of timber will thus play its part in conserving forest resources. The technical guide covers chemical hazards in the workplace, storage and transport accidents, release of contaminated effluents, disposal of chemical residues, contamination of soils, and residual hazards from chemicals incorporated into products. It also includes relevant and useful information on how to minimize the risks of pollution with proper design, operations and management. The guide has been designed for both government authorities and the wood preserving industry to assist in the use of environmental management tools including: environmental impact assessment (EIA), environmental auditing, risk assessment and other tools commonly used in industry today.

More information about the guide, ISBN 92 80714031, FFr100.00, USD20.00, is available from UNEP industry and Environment, Tour Mirabeau – 39–43, quai André Citroën, 75739 Paris Cedex 15, France. Telefax: +33 (1) 4437 1474. Telex: 20499F.

Pesticide residues in food – 1993

A report sponsored jointly by the United Nations' Food and Agriculture Organization and the World Health Organization on pesticide residues in food has been published as FAO Plant Production and Protection Paper 122. The volume is a report of the joint meeting of the FAO Panel of Experts on Pesticide Residues in Food and the Environment and the WHO Expert Group on Pesticide Residues which took place in Geneva, on 20–29 September 1993. The report includes evaluation of data for acceptable daily intake for humans and maximum residues limits for 39 products.

For more information about the report, ISBN 92-5-103443-5, contact: The Director, Publications Division, Food and Agriculture Organization, Viale delle Terme di Caracalla, 00100 Rome, Italy.

Pesticide residues on fruit and vegetables is a growing concern

Letter to the Editor

Following Professor Anders Thor's article on 'A New International Standard for Quantities and Units' in *Chem. Intl* **15**, 201–205 (1993), the editor received this reply.

Quantities and Units – Aspects

Gottfried Wilhelm Leibniz was employed by the councillor to the elector of Mainz shortly after graduation in mathematics from the University of Jena. He was given the major task to attempt a reconciliation between Catholics and Protestants. For this purpose, Leibniz pointed out that both creeds have the same central pillars (point 1 below) and hence that there was no reason for the fierce disputes between the two.

Gottfried W. Leibniz

born Leipzig, 21 June 1646
died Hanover, 14 November 1716
1 God – Immortality – Trinity
2 Differential–Integral calculus
3 Concept represented by a Code

Because of his lack of success Leibniz invented differential calculus in 1764 to express the smallness of the differences. However, mathematics was not readily appreciated by the opposing parties, so Leibniz took to coding concepts to make sure that misunderstandings did not emanate from misconception of terms.

There are some 4000 spoken languages about half of which can be expressed in a written form.

Global	4000	total
Global	2000	written
Global	300	'official'
EU-EFTA	25	'official'
EU-EFTA	3	'working'

Translation is prone to cause a shift in meaning especially when the concept identified by a term is not well defined. In this context chemistry is in a strong position in that no less than four out of five international systems (points 1–4 below) of communication are applicable.

Systems of writing
Bridging linguistic barriers

1 Symbols for chemical elements (IUPAC)
2 Mathematical signs and symbols (ISO)
3 Symbols for quantities (ISO)
4 International system of units (SI)
5 Notes for music

Adapted from Anders J Thor. A measure for all things. *Chem. Intl* **15**, 201–205 (1993).

In laboratory medicine Greek and Latin terms might be included, such as names of bacteria and a further advantage is volume of defined and coded concepts EC code values (IUBMB Enzyme Commission) and CAS code values (Chemical Abstract System). Electronic data processing and communication can now support exchange of information at a global level quite cheaply, both for developed and developing countries.

To aid accessibility, previous and present members of IFCC/C-QU and IUPAC/C-QUCC are collating and harmonizing information on properties and units in the clinical laboratory sciences to make it accessible on an electronic highway. Essential to this activity is:

- The standard systematic names of quantities defined are for bridging between systems, not for standardization of medical laboratory expressions for request / report.
- The syntax is based on the likeness of the various systems in actual use, not the differences.
- The 'atomic' parts forming the 'molecular' concepts listed as particular properties are well defined entities identified by a generally applicable code value, to the extent possible. This allows for expression in the language of choice. Our joint commission is engaged in the preparation of the following publications:

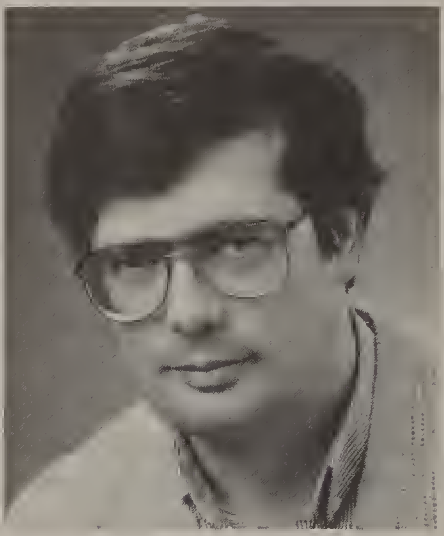
1 The 'Silver Book': Compendium of terminology and nomenclature of properties in clinical laboratory sciences, prepared by Christopher Rigg (NL) *et al.* as one of the series of IUPAC division books. This contains the theoretical background based on a compilation and harmonization of a plethora of recommendations from ISO, IFCC, IUPAC and other international organisation.
2 'Glossary of terms in quantities and units in clinical chemistry' prepared by H Peter Lehmann, Xavier Fuentes-Arderiu and Louis Bertello.
3 The 'Elephant': List of quantities measured in the clinical laboratory. Comprising:
    I. Syntax and semantic rules for quantities and units in clinical laboratory sciences.
    II. Names of quantities (in a general sense) in clinical laboratory sciences.
    III. Particular quantities in clinical laboratory sciences, terminology, coding, classification.

Apart from a hard copy format, the above documents should be accessible on an electronic highway (Gopher? World Wide Web? Mosaic?) in the fall of 1994.

Henrik Olesen
on behalf of IFCC/C-QU and IUPAC/C-QUCC
Clinical Chemistry Division: Commission on
Quantities and Units (VII.2)

Members: Henrik Olesen (Chairman), Gilbert Hill, Desmond Kenny, Patrick Storring, Xavier Fuentes-Arderiu, Pedro Soares De Araujo.

Paul Knochel



Young Professor wins 1994 Thieme–IUPAC Prize

A young professor working in Germany has won this year's Thieme–IUPAC prize worth DM 10 000. The prize is awarded every two years to the scientist under 40 who has made the most impact on the field of synthetic organic chemistry.

Professor Paul Knochel will be given this, the second Thieme–IUPAC prize, at the IUPAC International Conference on Organic Synthesis (ICOS) on December 12 in Bangalore, India, for his research into the synthesis, reactivity and application of novel organozinc compounds in organic synthesis.

Paul Knochel was born on 15 November 1955 in Strasbourg, France. After finishing his undergraduate studies in chemistry at the university of Strasbourg, he moved in 1979 to Zurich, where he received his PhD at ETH Zurich under the supervision of D. Seebach. From 1982 to 1986 he worked with J. F. Normant at the CNRS, Université P. et M. Curie, Paris, followed by post-doctoral research with M. Semmelhack at Princeton University. In 1988 he became assistant professor at the University of Michigan, Ann Arbor, where he became a full professor in 1991. In 1992 he accepted a position as C4-professor at the University of Marburg, thus becoming one of the youngest full professors in the field of organic chemistry in Germany.

Novel organozinc compounds in organic synthesis

Professor Knochel's high international recognition is based on his research connected with the synthesis, reactivity, and application of novel organozinc compounds in organic synthesis. Based on his research work at Paris he continued to develop the chemistry of germinal dimetallic compounds and has exploited the different reactivity of both carbon–metal (Zn and Mg) bonds. This led to a new diastereo-selective aldol reaction and to the discovery of a new reaction between the dimetallic compounds and unsaturated malonic esters, which leads to (*Z*)-olefins with very high stereoselectivity. With the help of mixed Zr,Zn-1, 1-dimetal compounds, (*E*)-olefins with good stereoselectivity could be produced alternatively. It was then that Professor Knochel noticed the tolerance of organozinc compounds for different functional groups, a fact that is of great importance for organic synthesis.

'Knochel reagents'

Confronted with the low reactivity of the C–Zn bond, he initiated a research program which led to internationally recognized advancements in this rapidly expanding domain of chemistry. In a broad spectrum of reactions, the transmetallation of alkyl–zinc compounds to mixed copper compounds of the type R Cu (CN) ZnI led to excellent reactivities, where R can be widely varied, for example having cyano, phosphonate, a-oxygen or a-sulfonate substituents. Even organozincs with relatively acidic CH protons could be produced. In the meantime these synthetically very valuable copper–zinc compounds have become known as the 'Knochel reagents'. Another important step to obtain interesting organozinc compounds was achieved with the direct insertion of zinc into benzyl, aryl and alkenyl halides with zinc powder. Even the corresponding sulfonates could be used for this reaction. Parallel to these tests new reactivities of organozinc compounds were discovered and the reagent ICH_2ZnI, which had previously been used only to obtain cyclopropanes, was then impressively used as a methylene-homologation reagent of copper compounds. This new method of homologation can be widely used and, for example, permits the diastereoselective synthesis of a-methylene-g-butyrolactones.

Iodo-zinc exchange reaction

While searching for new ways to produce organozinc compounds, Professor Knochel discovered the iodo-zinc exchange reaction, which for the first time made the production of primary dialkylzinc compounds possible. This is important because these reagents, in the presence of catalytic amounts of chiral titanium compounds, add to aldehydes with high enantioselectivity. Via this method a series of functionalized secondary alcohols with high enantiomeric excesses were obtained. Within the same range of tests palladium- and nickel-catalysed halogen–zinc exchange reactions were also discovered, which permit carbon–zinc reactions to occur via radical intermediates. With these last reactions Professor Knochel entered two additional important fields of chemistry, namely asymmetric synthesis and stereoselective radical chemistry. One can expect many more exciting discoveries from Professor Knochel, especially in the extremely important field of stereoselective catalytic processes.

The first Thieme–IUPAC Prize was awarded in 1992 to Stuart Schreiber (Harvard, USA) for his outstanding achievements in the application of sophisticated chemical synthesis to crucial problems at the frontiers of molecular biology.

We regret to record the deaths of

Prof. C.C. Addison, UK (1st April 1994) – Committee on Teaching of chemistry (1979–85)

Prof. J. Chatt, UK (19 May 1994) – Commission on Nomenclature of Inorganic Chemistry (1973–1981), Interdivisional Committee on Nomenclature and symbols (1977–1981)

Prof. C. E. Vanderzee, USA (20 July 1993) – Commission on thermodynamics (1975–83), Commission on Solubility Data (1979–83)

Canadians celebrate IUPAC's 75th Anniversary

Canadian chemists celebrated the 75th anniversary of IUPAC with a Gala Symposium featuring four of Canada's Nobel Laureates in Chemistry on Sunday 29 May 1994. This once-in-a-lifetime event was held in Winnipeg, Manitoba, in conjunction with the Canadian Society for Chemistry's Annual Conference. It was attended by an audience of about 600. The theme 'Chemistry for life' was proposed by Swedish chemists in order to emphasize the contributions of chemistry to all aspects of life.

Dr Ian Smith, Master of ceremonies for the Symposium, said 'It was phenomenally exciting to have so much intellectual horsepower together in one place'. The four speakers were:

Dr G. Herzberg (National Research Council of Canada), winner of the 1971 Nobel Prize for his work on molecular spectroscopy,

Prof. J. C. Polanyi (University of Toronto), winner of the 1986 Nobel Prize for his research on chemical kinetics,

Prof. R. A. Marcus (California Institute of Technology), winner of the 1992 Novel Prize for work on electron-transfer reactions,

Prof. M. Smith, winner of the 1993 Nobel Prize for his research on the chemistry of DNA.

The subject of the talks ranged from 'Biochemical Pathways' (Prof. Smith), 'Theory and Experiment in Electron-Transfer Reactions' (Prof. Marcus), 'Reminiscences of 60 years in Science' (Dr Herzberg) and, to close the symposium, 'Who Needs Science?' (Prof. Polanyi).

The Symposium was organized by the Canadian National Committee for IUPAC (Secretary, Dr J.R. Morton), and co-sponsored by CNC/IUPAC, the Canadian Society for Chemistry and the Steacie Institute of the National Research Council of Canada.

International recommendation

The Organization Internationale De Métrologie Légale (OIML), the world-wide intergovernmental organization whose primary aim is to harmonize the regulations and metrological controls applied by national metrological services, has produced the International Recommendation *Portable gas chromatographs for field measurements of hazardous chemical pollutants*. Copies are available from: Bureau Internationale de Métrologie Légale, 11 Rue Turgot, 75009 Paris, France. Tel: +33 1 48 78 12 82; Fax: +33 1 42 82 17 27.

Four Canadian Nobel Laureates in Chemistry, speakers at a Symposium celebrating the 75th Anniversary of IUPAC. Left to right: Drs Polanyi, Marcus, Herzberg and Smith.

The role of science in the rebuilding of the countries of the former Soviet Union

The aim of the recent Conference on the Role of Science In Rebuilding the Countries of the former Soviet Union was to draw attention to the serious problems facing science in the former Soviet Union and to explore strategies for solutions. The conference, held at Leeds Castle, UK, in June 1994, was organized by the International Council of Scientific Unions in co-operation with UNESCO and the Directorate General XII of the European Commission. The conference identified a list of priorities for future action. These included:

- discourage the brain drain by supporting scientists *in situ* and by supporting short-term training opportunities abroad;
- organize workshops to help the integration of FSU science into global international science;
- convene specific seminars, e.g. one on natural disasters in Asia;
- provide an independent review of the potentials of science in individual countries;
- provide for twinning of professors/chairs from the countries of the FSU with other institutions in Europe or other similar countries
- continue building links with Europe and the rest of the world;
- undertake a study of scientific policy structures in the different countries of the FSU;
- encourage the setting up and use of E-mail networks.

Synthetic chemists reach Olympian heights

Researchers at the University of Birmingham have synthesized a molecule which mimics the five interlinked rings of the Olympic flag. The synthesis of this linear pentacatenane, dubbed olympiadane, has been achieved by Dr J. Fraser Stoddart and Dr David Amabilino and their colleagues at the University of Birmingham. They have reported their synthesis in *Angewandte Chemie*. The molecule itself is unlikely to have a use, but the techniques used to make the molecule may help toward understanding how components of a complex molecule can spontaneously join together.

Names and addresses

Full details (names, addresses, telephone/telex/fax numbers and e-mail) of officers of IUPAC bodies were published in *Chem. Intl.* **15**, 215–227 (1993). The IUPAC Secretariat has since been notified of the following changes:

Dr John R. MOODY (Chairman, Commission on Isotope Specific Measurements as References) National Institute of Standards & Technology, Room B208, Building 222, Gaithersburg, MD 20899, USA. Tel.: + 1 (301) 975 4134; Fax.: +1 (301) 869 0413.

Change of Editor for CI

IUPAC has appointed Jeffrey Williams to succeed Mike Freemantle as its Information Officer/Affiliate Affairs Secretary. He joined the staff at the Oxford Secretariat at the beginning of October.

Williams received a BSc degree in chemistry from the University College of Wales at Aberystwyth in 1977 and a PhD in chemistry from Cambridge University in 1981. He carried out three years of post-doctoral research work, firstly at Manchester University and then in the USA at Harvard University and University of Illinois. Subsequently he returned to Cambridge as a research scientist, and later moved as a staff scientist to the Institut Max von Laue-paul Langevin at Grenoble. Since 1992 he has been editor for physical sciences in the Europe office of Science, the weekly publication of the American Association for the Advancement of Science. In addition to his research papers, Williams has written a number of semipopular articles on science.

Jeffrey Williams.

Commission & Committee News

Transport Properties

Eighteen scientific presentations were made on specific topics related to the ongoing projects of the subcommittee on Transport Properties (Commission 1.2: Thermodynamics) in June in Boulder, CO, USA.

Standard reference data for the transport properties of fluids

- The work related to the proposition of toluene as a reference fluid for high-pressure viscosities is continuing satisfactorily.
- A new recommendation for the viscosity of ammonia was concluded and approved by the subcommittee for publication under its auspices.
- There will be a revision of the recommendation for the transport properties of carbon dioxide based on new measures especially commissioned by the subcommittee to resolve uncertainty. This work will also be published under the subcommittee auspices.

Midas databank of transport property data

The work carried out by Prof. K. Stephan and Mr R. Krauss in compiling all recent and unpublished results on transport property measurements is to be continued with emphasis on the refrigerants.

Book on theory and prediction of the transport properties

The editors, Prof. C. A. Nieto de Castro, Dr J. Millat and Dr J. H. Dymond, informed the members that the book is almost ready and it will be submitted to Cambridge University Press in September 1994.

Round Robin project on R134a

The project aiming to reconcile the profound differences of the transport properties of R134a between the data obtained in different countries within IUPAC is well on the way with seven participating laboratories already having completed their measurements. Additional offers of contributions from four more countries have been received. The subcommittee is grateful for the sum of $1000 IUPAC contributed for this project.

Prof. Marc J. Assael

More Emphasis on Local Pollution

On 18 July 1994, the Commission on Atmospheric Chemistry (VI.4) met for its yearly meeting, this time hosted by Prof. Xiaoyan Tang, Centre of Environmental Studies, Peking University, China. The Commission discussed future developments at length and came to the decision that local environmental problems, especially of fast developing countries, should be a major focus in the future. Many international organisations are devoted to environmental problems on continental to global scales, but relatively little attention is given to the local environmental problems which confront directly many fast developing countries.

Ongoing and new projects such as the development of sampling networks, the use of passive samplers for monitoring ambient air, assessment of the influence of atmospheric deposition on water quality (in collaboration with Commission VI.6), local and regional ozone problems connected to mesoscale oxidant formation as well as a Workshop on Local Air Pollution in Rapidly Developing Countries, organised by VI.4 in connection with this meeting, demonstrate the activities of the Commission in this area.

The Commission decided that the series of articles on local environmental problems in Chemistry International will be continued. three articles (India, Japan, The Netherlands) have already been printed. Three more (Russia, Germany and Turkey) will appear soon. The next series will describe local environmental problems in Italy, Croatia, Brazil and Korea.

The collaboration with Commission VI.6 Water Quality and a number of UN organisations active in the field of local and regional air pollution will be intensified in order to speed up work on the assessment of the influence of deposition water quality. The Commission has expressed the view that the project is, by necessity, very large and ambitious but also that this issue has a very high priority.

The Commission supports initiatives to organise two workshops:

1. Workshop on Education in Atmospheric Chemistry.The preliminary report of Prof. Xiaoyan Tang and Prof. Nicolai Bazhin and articles of Prof. Jack Calvert on this issue have made clear that a great need for information on courses, materials and educational aids exist for this particular subject.
2. Workshop on the use of passive samplers for monitoring ambient air. The Commission will seek collaboration of other organisations in order to organise this workshop in 1996.

The next meeting of the Commission will take place during 1995 IUPAC General Assembly in Guildford, UK over the period 4–11 August.

Prof. J. Slanina
Chairman, Commission VI.4

Affiliate Affairs

Information for affiliates

IUPAC publications

Affiliates are entitled to a 25% reduction and in some cases a 40% reduction on the cost of IUPAC publications except the scientific journal *Pure and Applied Chemistry*. A leaflet detailing IUPAC books currently available from Blackwell Scientific Publications has recently been distributed by the publishers to all *CI* readers. Further copies may be obtained from the IUPAC Secretariat.

How to contact commissions

IUPAC affiliates are entitled to communicate directly on scientific matters with the officers of IUPAC commissions. A full list of names and addresses of all commission officers for 1994–95 was published in the November 1993 issue of *CI*.

IUPAC-sponsored conferences

If you are interested in attending a conference please apply directly to the conference organizers for the conference circulars and registration forms. An updated list of names and addresses of the organizers of all future IUPAC sponsored conferences is given in the 'Conference Calendar' published in each issue of *CI*.

Ties and scarves

IUPAC ties and scarves may be purchased from the IUPAC Secretariat by applying to the Affiliate Affairs Secretary. The colours for both are *either* maroon *or* navy (dark) blue. The ties cost USD 14.00/GBP 7.00 each and the scarves USD 12.00/GBP 6.00 (including postage and packing).

Please use the form (or a photocopy of it) published on page 24 of the January 1994 issue of *CI*. Alternatively please write to the Affiliate Affairs Secretary with your order stating the colour you require. A cheque made payable to IUPAC for the appropriate amount should be enclosed with your order.

IUPAC poster

Copies of an IUPAC poster are available **free of charge** to affiliates and members of IUPAC's commissions and committees. The poster is printed in maroon and black on a white background and is approximately 42 × 59 cm in size.

IUPAC welcomes any publicity you can give to its activities. If you would like to display one or more copies of the poster in your department or elsewhere please write to the Affiliate Affairs Secretary stating your name and address and how many copies of the poster you wish to receive.

Address of IUPAC Secretariat

Please use the following address for all communications directed to the IUPAC Affiliate Affairs Secretary. If your are submitting a letter for publication in *Chemistry International* (*CI*), please indicate that the letter is 'Submitted for publication in *CI*.'

Affiliate Affairs Secretary, IUPAC Secretariat, Bank Court Chambers, 2–3 Pound Way, Templars Square
Cowley, Oxford OX4 3YF, UK.
Tel: +44 (865) 747744; Fax: +44 (865) 747510
E-mail: iupac@vax.oxford.ac.uk

Affiliate reduction of conference registration fees

It is a condition of IUPAC sponsorship of a conference that IUPAC affiliates are entitled to a 10% reduction or 'own members' rate on the registration fee for scientific participants. This concession is usually, but not always, announced in the conference circulars and indicated on the registration form.

To receive this reduction an affiliate must declare on the conference registration form that (s)he is an affiliate. Alternatively the affiliate should apply in writing to the conference organizer for this reduction stating that (s)he is an affiliate. Conference organizers may check with the IUPAC Secretariat that applicants for this reduction are currently registered as affiliates.

If an application for this reduction is refused, an affiliate should immediately notify the Affiliate Affairs Secretary and, if possible, forward copies of documentary evidence of this refusal.

Have you received your affiliate documents?

Every affiliate receiving a copy of the May 1994 issue of *CI* should have found, inserted in the magazine, a white envelope addressed to affiliates. The envelope contained the following documents:

- a letter from the IUPAC Affiliate Affairs Secretary;
- an IUPAC affiliate membership card valid until May 1995;
- an IUPAC affiliate membership certificate;
- an IUPAC affiliate membership registration form to be completed and returned to the IUPAC Secretariat.

If your copy of the magazine did not contain this package of documents *and* you are a registered affiliate for 1994, then please inform the Affiliate Affairs Secretary at the IUPAC Secretariat. Replacement documents will be sent to you.

Conferences

International Conference on Organic Synthesis (ICOS-10)
Bangalore, India
11–16 December, 1994

IUPAC
SPONSORED

This IUPAC-sponsored conference is being organized by the Indian Institute of Science and the Jawaharlal Nehru Centre for Advanced Scientific Research. It is also sponsored by the Indian National Science Academy and the National Organic Symposium Trust. It will be held in the National Science Seminar Complex, Indian Institute of Science, and will cover: synthesis of natural and non-natural products; design of new reactions, reagents and techniques for organic synthesis; asymmetric synthesis; organometallic chemistry; design of new materials; and molecular recognition. It will include plenary lectures, section lectures and invited short presentations together with poster presentations. The 2nd Thieme–IUPAC award lecture will also be delivered at ICOS-10 (see news story on p. 230). There will be a technical exhibition of books, equipment and products and four pre and post-symposia are also being organized. The plenary and invited section lectures will be published in *Pure and Applied Chemistry*.

The registration fee for participants is now USD350, while participants from third world countries will pay USD200, accompanying persons USD125 and students USD75. IUPAC Affiliate Members are entitled to a 10% reduction in the fee. IUPAC sponsorship implies that entry visas will be granted to all bona fide chemists provided application is made not less than three months in advance.

Bangalore – the garden city.

Bangalore – the garden city – will be pleasant during December with plenty of sunshine and a temperature range of 17–23 °C.

IUPAC Symposium on Polymer Morphology and Electrical Properties
L′odz, Poland
5–7 July 1995

IUPAC
SPONSORED

The IUPAC Symposium on Polymer Morphology and Electrical Properties will bring together scientists and engineers active in the field of polymer structure and morphology with those engaged in studying electrical properties of dielectric semiconducting and conducting polymers. Active participation of both a academic and industrial researchers is encouraged.

The symposium will include invited lectures, oral communications and poster sessions. Young scientist and research students are encouraged to participate. An exhibition of scientific instruments is also planned. Invited papers and other selected material will be published as a special volume of Macromolecular Symposia

Łodz is Poland's second largest city, situated in the centre of Poland on the flat Mazovia plane. It is easily accessible from Warsaw by train (90 minutes) and there are direct flights to Warsaw from major European and North American cites.

The village of Łodz has existed since 1332, swelling to a city in 1820 with the growth of its textile industry following the invention of the steam engine. Today the population totals around 850 000 and the city is still the centre of Poland's textile industry. Łodz is well known as a cultural centre with is opera house, operetta and many theatres. It has two universities, a school of art, a renowned film school and two medical schools. Museums include the world famous museum of contemporary art, the museum of textiles and the museum of cinematography. Ludwik Zamenhof, the inventor of Esperanto and Arthur Rubinstein, the pianist, were both born in the city.

The registration fee for participants is approximately USA 250, while students and participants from Central and Eastern Europe, and accompanying persons pay USD50. IUPAC Affiliate Members are entitled to a 10% reduction in the fee. Accommodation is at hotels near the University and rooms in the student quarters will be available at a reduced rate. IUPAC sponsorship implies that entry visas will be granted to all bona fide chemists provided application is made not less than three months in advance.

For more information please contact: The Centre of Molecular and Macromolecular Studies, Polish Academy of Sciences, Sienkiewicza 112, 90–363 Lodz, Poland. Tel: +48 42 818952; Fax: +48 42 847126; Telex: 886742 pan pl; E-mail: julanski@lodzl.p.lodz.pl

15th International Congress of Heterocyclic Chemistry Taipei, Taiwan 6–11 August 1995

IUPAC SPONSORED

This IUPAC-sponsored congress will be held in the Taipei International Convention Centre. It will cover: organic synthesis in heterocyclic chemistry; asymmetry and heterocycles; heterocyclic pharmaceuticals and agrochemicals; molecular recognition by heterocycles; bioorganic chemistry of heterocycles; new heterocyclic materials. The Congress is sponsored by the International Society of Heterocyclic Chemistry.

The conference will include plenary lectures, invited lectures, oral presentations and poster sessions. The following prominent scientists have agreed to present plenary lectures: C. H. Heathcock (Berkeley), Y. Ito (Kyoto), J.-M. Lehn (Strasbourg), S. V. Ley (Cambridge), K. Mori (Tokyo), G. R. Newkome (South Florida), R. Noyoris (Nagoya), E. Vogel (Koln), S. M. Weinreb (Penn State) C.-H. Wong (Scripps Institute).

The registration fee before 1 April 1995, is USD300 for IUPAC/ISHC participants, USD350 for others, with a student fee of USD100 (IUPAC/ISHC members) USD150 (non-members).

A postconference symposium, *Hong-Kong International Symposium on Heterocyclic Chemistry,* will be held at the University of Hong Kong on 13–16 August 1995 and a connected conference, *The Fourth International Conference on Heteroatom Chemistry,* will be held on 1–6 August 1995 in Seoul, Korea.

Taipei is the largest city in Taiwan and a major international centre with a population of some 3 million. It has many tourist attraction including the National Palace Museum.

12th International Symposium on Plasma Chemistry Minneapolis, USA 21–21 August 1995

The International Symposium on Plasma Chemistry (ISPC) is an international conference held biennially at host institutions around the world. It is the main plasma chemistry conference encompassing the whole area of plasma chemistry including high pressure thermal plasmas, low-pressure nonequilibrium plasmas, and corona discharges. Topics covered range from the basic physics and chemistry of these discharges to the study of industrial plasma processing techniques and equipment. The conference is structured to facilitate the exchange of information and ideas between basic/applied researchers in plasma chemistry and industrial practitioners of plasma processing technology, within an international framework.

ISPC-12 will consist of a 5-day Symposium, incorporating a Plasma Equipment Exposition, proceeded by a 2-day Summer School on Plasma chemistry and followed by a 1-day Workshop on Industrial Applications of Plasma Processing.

The symposium will consist of a series of parallel oral sessions, poster sessions, and plenary lectures covering the entire field of plasma chemistry and plasma processing. The main topics include modelling, diagnostics, volume synthesis, thin film processing, plasma metallurgy, and other applications.

The Summer School of Plasma Chemistry held prior to the Symposium will consist of courses providing an introduction to the fundamentals and applications of plasma chemistry and plasma processing. It is intended for scientists, engineers and managers who want an introduction and overview of the subject area. The workshop held following the symposium will focus on recent industrial applications, developments, and concerns in thermal and low pressure plasma processing.

ISPC-12 will be held at the University of Minnesota in Minneapolis which, with its twin city of St Paul, is situated at the confluence of the Mississippi, Minnesota and St Croix Rivers. The area is the economic and cultural hub of the heartland region of North America with an abundance of shops, restaurants and cultural activities. Both cities encompass a multitude of lakes and parks.

Accommodation will be available in the University campus dormitories and at several hotels adjoining the site. The conference facilities are adjacent to several campus-orientated restaurants and shops, about ten blocks from downtown Minneapolis with its host of restaurants, shops, entertainment facilities and cultural activities. Registration fees will be included in the second announcement to be published at the end of November.

For more information please contact: ISPC-12, c/o Catherine Ploetz, 218 Nolte Centre, University of Minnesota, 315 Pillsbury Drive SE, Minneapolis, MN 55455, USA. Tel: +1612 6262259; Fax: +1612 626 1632. Internet: ispc12@pdcs.cee.umn.edu.

AIMECS 95 Tokyo, Japan 3–8 September 1995

IUPAC SPONSORED

The Asian Federation for Medicinal Chemistry (AFMC) International Medicinal Chemistry Symposium being held in Tokyo in 1995 is the first joint symposium of the AFMC, the European Federation for Medicinal Chemistry (EFMC) and the American Chemical Society's Division of Medicinal Chemistry (USMC). It will include sessions on: chemistry for pharmaceuticals; computer-assisted drug design; endogenous substances; receptors: structure and function; enzyme inhibitors; drug metabolism and toxicology; drug delivery; glycobiology and glycotechnology; traditional medicine; regulatory affairs; and topics from the pharmaceutical industry.

This IUPAC-sponsored conference is organized by the Pharmaceutical Society of Japan for the Asian Federation of Medicinal Chemistry and will be held in the Keio Plaza InterContinental Hotel in Tokyo.

Chromatography of polymers and related substances Bratislava, Slovakia 18–22 September 1995

IUPAC SPONSORED

The first details of this IUPAC-sponsored conference are now available. The conference will bring together theoreticians and experimentalists working in the field of characterization by chromatographic techniques of both synthetic and natural polymers, oligomers and related substances. The conference is organized under the auspices of the International Union of Pure and Applied Chemistry, the Polymers institute of the Slovak Academy of Sciences and the Slovak Chemical Society, and is part of the 10th Bratislava International Conference on Macromolecules.

Current results of chromatographic method development and application will be presented including progress in the industrial process separations and characterization of complicated systems like polymer blends and copolymers. Topics will include: Development of methods including hyphenated techniques; chromatography of synthetic polymers; chromatography of natural polymers, and oligomers and admixtures in polymers. All contributions will be presented as posters with more detailed information on the poster format contained in the second circular.

A plenary panel discussion on the future developments in the field of chromatography of polymers will be organized. Summaries of lectures and poster contributions will appear in the programme booklet with publications of the full texts of the main lectures and posters contributions in a special volume of *Macromolecular Chemistry and Physics, Macromolecular Symposia.*

Registration fees will be USD270 for participants, USD110 for students and accompanying persons. IUPAC Affiliate Members are entitled to a 10% reduction in the fee and participants from Central and East European countries will be entitled to the reduced fee of USD50 which does not include lunches and banquet. The conference will be held in the Slovak Academy of Sciences and accommodation will be available in the halls of residence and in local hotels.

For more information, please contact: Conference Chairman Dr Dusan Berek, Polymer Institute of the Slovak Academy of Sciences, Dubravska cesta 9, Sk-842 36 Bratislava, Slovakia. Tel +42 7378 2306; Fax: +42 7375 923; E-mail: upoldber@savba.sk.

31st International Conference on Co-ordination Chemistry (ICCC) Vancouver, Canada 18–23 August 1996

The 31st ICCC will cover all aspects of co-ordination chemistry with special attention being paid to fields which are currently rapidly emerging and developing. There will be six plenary lectures chosen to cover themes of general interest, to which mini-symposia will be linked. There will also be session lectures and poster sessions.

The conference will be held on the campus of the University of British Columbia, on 450 hectares of woodland only 10 km from downtown Vancouver. The University's setting, with views of the ocean and snow-capped mountains, is one of the most spectacular in the world.

Accommodation is available on campus or in hotel rooms in Vancouver.

For further information, please contact: 31st ICCC Secretariat, UBC Conference Centre, 5961 Student Union Boulevard, Vancouver, BC, Canada V6T 2C9. Tel: +1604 8221050; Fax: +1604 8221069.

Vancouver, with one of the greatest views in the world.

Conference Calendar

1994

Functional & high performance polymers

14–16 November
International Symposium on Functional & High Performance Polymers. Taipei, Taiwan, China.
IUPAC International Polymer Symposium, Taipei (IPST) Seceretariat, Prof. Ging-Ho Hsiue, Department of Chemical Engineering, National Tsing Hue University, Hsinchu, Taiwan 300, China. Fax: +886 (35) 726825. E-mail: ipst@nthu.edu.tw

Organic synthesis

11–16 December
10th International Conference on Organic Synthesis. Bangalore, India.
Prof. G. S. R. Subba Rao, (Secretary, ICOS-10), Department of Organic Chemistry, Indian Institute of Science, Bangalore 560 012, India.

1995

Macrocyclic chemistry

2–7 July
20th International Symposium on Macrocyclic Chemistry. Jerusalem, Israel.
Prof. D. Meyerstein, Chemistry Department, Ben-Gurion University of the Negev, P.O.B. 653, Beer-Sheva 84105, Israel.

Polymer morphology and electrical properties

5–7 July
International Symposium on Polymer Morphology and Electrical Properties. Lodz, Poland.
Prof. A. Galeski, Centre of Molecular & Macromolecular Studies, Polish Academy of Sciences, Sienkiewicza 112, 90–363 Lodz, Poland. Tel: *+48 (42) 818952 or 815761. Fax: +48 (42) 847126 or 815483. E-mail: julanski@lodzl.p.lodz.pl.*

Analytical chemistry

9–15 July
SAC 95: International Conference on Analytical Chemistry. Hull, UK.
Prof. A. Townshend, School of Chemistry, University of Hull, Hull HU6 7RX, UK. Tel: +44 (482) 465027. Fax: +44 (482) 466410.

Toxicology and clinical chemistry of metals

10–13 July
5th COMTOX Symposium on Toxicology and Clinical Chemistry of Metals. Vancouver, BC, Canada.
Prof. F. W. Sunderman, Jr., Departments of Laboratory Medicine and Pharmacology, University of Connecticut Medical School, Post Office Box 1292, Farmington, Connecticut 06034–1292, USA. Tel: +1 (203) 792328. Fax: +1 (203) 6792154.

High swelling gels

10–14 July
36th Microsymposium on Macromolecules - High Swelling Gels. Prague, Czech Republic.
Prof. B. Valter, Institute of Macromolecular Chemistry, Academy of Sciences of the Czech Republic, Heyrovského nám 2, 162 06 Prague 6-Petriny, Czech Republic. Tel: +42 (2) 360317. Fax: +42 (2) 367981.

Functional dyes

16–21 July
3rd International Symposium on Functional Dyes (Functional Dye '95). Santa Cruz, California, USA.
Dr. J. Pacansky, IBM - Almaden Research Center, K42/803, 650 Harry Road, San Jose, CA 95120–6099, USA.

Heteroatom chemistry

30 July – 4 August
4th International Conference on Heteroatom Chemistry. Seoul, Korea.
Prof. Y. H. Kim, Department of Chemistry, Korea Advanced Institute of Science & Technology, Yusung-Gu, Taejon, 305–701, Korea. Tel: +82 (42) 8692818. Fax: +82 (42) 8695818 or 2810.

IUPAC General Assembly

4–11 August
38th IUPAC General Assembly. Guildford, Surrey, UK.
The IUPAC General Assembly is not open for general participation but restricted to members of IUPAC bodies that meet on this occasion

Organometallic chemistry directed toward organic synthesis

6–10 August
8th IUPAC Symposium on Organometallic Chemistry directed toward Organic Synthesis (OMCOS-8). Santa Barbara, California, USA.
Prof. B. H. Lipshutz, Department of Chemistry, University of California, Santa Barbara, California 93106–9510, USA. Tel: +1 (805) 8933072. Fax: +1 (805) 8937287. E-mail hr03conf@ucsbvm.ucsb.edu.

How to apply for IUPAC sponsorship

To apply for IUPAC sponsorship, conference organizers should write to the IUPAC Secretariat (see inside back cover for address) requesting an Advanced Information Questionnaire (AIQ). Completed AIQs should be returned to the Secretariat preferably 2 YEARS and at least 12 months before the conference. Late applications will not be considered. Further information on granting of IUPAC sponsorship was published in *Chem. Intl.* **14**, 203 (1992).

Heterocyclic chemistry

6–11 August
15th International Congress of Heterocyclic Chemistry. Taipei, Taiwan, China.
Prof. Chin-Kang Sha, Department of Chemistry, National Tsing Hua University, Hsinchu 300, Taiwan, China. Tel: +86 (35) 722427. Fax: +86 (35) 725870. E-mail: cksha@chem.nthu.edu.tw.

35th IUPAC Congress

14–19 August
35th IUPAC Congress.
Istanbul, Turkey.

Professor A. R. Berkem, 35th IUPAC Congress, Halaskargazi Cad. No:53, D.8, 80230 Harbiye, Istanbul, Turkey. Tel: (90) (212) 240 7331. Fax: (90) (212) 231 7037.

Plasma chemistry

21–25 August
12th International Symposium on Plasma Chemistry. Minnesota, Minneapolis, USA.
ISPC-12, c/o Catherine Ploetz, 218 Nolte Center, University of Minnesota, 315 Pillsbury Drive SE, Minneapolis, MN 55455, USA.

Spectroscopy

27 August-1 September
29th Colloguium Spectroscopicum Internationale. Leipzig, Germany.
Prof. H. Nickel, Forschungszentrum Jülich GmbH, Institut für Werkstoffe der Energietechnik, RWTH Aachen, D-52425 Jülich, Germany.

Industry – education initiatives in chemistry

28 August – 2 September
International Symposium on Industry – Education Initiatives in Chemistry. York, UK.
Prof. D. J. Waddington, Department of Chemistry, University of York, Heslington, York, YO1 5DD, UK.

Medicinal chemistry

3–8 September
AFMC International Medicinal Chemistry Symposium (AIMECS 95). Tokyo, Japan.
Prof. S. Ikegami, Secretary General, AIMECS 95, c/o Faculty of Pharmaceutical Sciences, Teikyo University, Sagamiko, Kanagawa 199–01, Japan. Tel: +81 (426) 850161. Fax: +81 (426) 851870.

Ionic polymerization

4–8 September
1st International Symposium on Ionic Polymerization. Istanbul, Turkey.
IUPAC International Symposium on Ionic Polymerization, c/o Prof. Y. Yagci, Istanbul Technical University, Faculty of Science, Department of Chemistry, Maslak 80626, Istanbul, Turkey.

Applications of the Mössbauer effect

10–16 September
International Conference on the Applications of the Mössbauer Effect (ICAME-95). Rimini, Italy.
Prof. I. Ortalli, University of Parma, Istituto di Scienze Fisiche, Via M. D'Azeglio, 85, 43100 - Parma, Italy.

Bioorganic chemistry

17–23 September
3rd International Symposium on Bioorganic Chemistry. Dagomys, Sochi region of Black Sea Coast, Russia.
Prof. V. T. Ivanov, Shemyakin & Ovchinnikov Institute of Bioorganic Chemistry, Russian Academy of Sciences, Ul. Miklukho-Maklaya, 16/10, 117871 Moscow V-437, Russia.

Chromatography of polymers

18–22 September.
International Symposium on Chromatography of Polymers and Related Substances. Bratislava, Slovakia.
Dr. D. Berek, Polymer Institute of the Slovak Academy of Sciences, Dúbravská cesta 9, Sk-842 36 Bratislava, Slovakia. Tel: +42 (7) 3782306. Fax: +42 (7) 375923.

1996

Free-radical polymerization

26–31 May
2nd International Symposium on Free-Radical Polymerization: Kinetics and Mechanism. Santa Margherita Ligure, Genoa, Italy.
Prof. S. Russo, Department of Chemistry, University of Sassari, Via Vienna 2, I-07100 Sassari, Italy.

Organic synthesis

30 June-4 July.
11th International Conference on Organic Synthesis. Amsterdam, Netherlands.
Prof. W. N. Speckamp, University of Amsterdam, Laboratory of Organic Chemistry, Nieuwe Achtergracht 129, 1018 WS Amsterdam, Netherlands.

Catalysis

30 June – 5 July.
11th International Congress on Catalysis. Baltimore, USA.
Prof. Gary L. Haller, Department of Chemical Engineering, Yale University, PO Box 208286, New Haven, CT 06520–8286, USA. Tel: +1 (203) 432 4378. Fax: +1 (203) 432 4387.

(Bio)degradable polymers

15–18 July
37th Microsymposium on Macromolecules (Bio)degradable Polymers: Chemical, Biological and Environmental Aspects. Prague, Czech Republic.
Dr. B. Valter, Institute of Macromolecular Chemistry, Academy of Sciences of the Czech Republic, Heyrovského nám 2, 162 06 Prague c-Petriny, Czech Republic.

Macromolecules

4–9 August
36th International Symposium on Macromolecules. Seoul, Republic of Korea.
Prof. Un Young Kim, Korea Institute of Science & Technology, PO Box 131, Cheongryang, Seoul 130–650, Republic of Korea. Tel: +82 (2) 957 6104. Fax: +82 (2) 957 6105.

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International Union of Pure and Applied Chemistry (IUPAC)

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The International Union of Pure and Applied Chemistry (IUPAC), formed in 1919, is a voluntary non-governmental, non-profit association of organizations, each of which represents the chemists of a member country.

Its objectives are:

- to promote continuing co-operation among the chemists of the member countries;
- to study topics of international importance to pure and applied chemistry which need regulation, standardization, or codification;
- to co-operate with other international organizations which deal with topics of a chemical nature;
- to contribute to the advancement of pure and applied chemistry in all its aspects.

The membership of IUPAC presently comprises 40 countries, each represented by a national organization, such as an academy of science or research council.

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0193-6484(199411)16:6,1-M

Printed in England by Bocardo Press